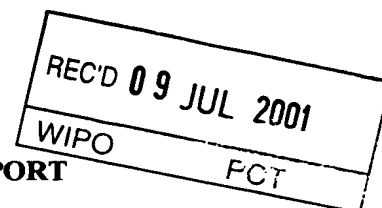


PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)



14

Applicant's or agent's file reference VAL 201 PCT	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI00/00190	International filing date (day/month/year) 10.03.2000	Priority date (day/month/year) 12.03.1999
International Patent Classification (IPC) or national classification and IPC ₇ D 21 H 23/28		
Applicant Valmet Corporation et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 28.08.2000	Date of completion of this report 28.06.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Barbro Nilsson/ELY Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00190

I. Basis of the report

1. With regard to the **elements** of the international application:*

- ☐ the international application as originally filed
- ☒ the description:
pages 1-8, 10-16, as originally filed
pages _____, filed with the demand
pages 9, filed with the letter of 19.04.2001
- ☒ the claims:
pages 18-20, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages 17, 21-25, filed with the letter of 19.04.2001
- ☒ the drawings:
pages 1-7, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00190

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-46</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-46</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-46</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The present invention relates to a method and an assembly for coating or surface sizing webs of paper and board.

It is an object of the invention to provide a method for surface treating a web of paper or board prior to the cylinder dryer section while the solids content of the web is low. The goal of the invention is achieved by way of passing the web supported by a transfer belt through at least one surface treatment section such as a coater station.

New independent claims 1 and 26 have been filed with the letter of 19 April 2001. The feature that the transfer belt is impervious to water has been included in the claims. An important feature with a water impervious transfer surface is that water cannot move towards the treated surface, but is pressed in the web.

Relevant documents cited in the International Search Report:

D1 EP 0881329 A2

D2 US 5575891 A

D1 discloses a method of applying a suspension onto the surface of a wet paper web that is supported by a felt (5a). The surface treatment is performed prior to the drying section of dryer cylinders.

D2 discloses a method of surface treating a web of wet tissue paper prior to drying of the paper web. A distributing roll (21) distributes an emulsion onto a papermaking belt (10), which supports the paper web. The emulsion is transferred from the belt to the web with aid of a vacuum pickup shoe (24a).

.../...

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00190

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

The transfer belt in the invention differs from the felt (5a) in D1, and the papermaking belt (10) in D2, in that it is impervious and thus works in a different way than that in D1 and D2. In D1 the paper web is supported by a felt, which is pervious. Even if D2 cites a belt, which usually means an impermeable material, it is clear from the way it works that it is porous. Thus, none of the documents disclose the use of an impervious transfer belt, which is a characteristic feature of the invention.

Therefore, the claimed invention is novel, considered to involve an inventive step and have industrial applicability.

is metered and the size is smoothed on the belt surface by means of a rod or blade.

As is shown in FIG. 1, the applicator devices S1A and S1B
5 can be used alternatively or even simultaneously when a large amount of surface size has to be applied to the same surface of the web. Next, the transfer belt 9 with the web travelling thereon is passed into a nip between a deflecting backing roll 11 and a press roll 12, wherein
10 water is removed from the web toward the first felt 4. The transfer belt 9 with the web running thereon passes over the deflecting backing roll 11. In the illustrated embodiment, a shoe press 13 adapted to operate against the deflecting backing roll 11 over which a belt or the
15 felt 14 is adapted to pass. In order to apply surface size to the untreated side of the web, this embodiment has a spray applicator S2 adapted at a point along the web passage between the nip of the press roll 12 and its backing roll 11 and the nip between the shoe press 13 and
20 its backing roll. In this arrangement, the first coated side of the web will face the belt 14 that runs over the shoe press 13. If the nip of the shoe press is adapted to have a transfer belt on both sides thereof, no dewatering takes place in the nip, but rather, the press acts as a
25 calender that smooths the web surface.

From the shoe press 13, the web travels on the transfer belt 9 out from the shoe press nip. The web is picked
30 from the transfer belt 9 onto the dryer wire 15 of the dryer cylinder group by a third suction roll 16. Adherence of the web to the felt is secured by means of a suction box 17, and the final drying of the web is carried out by means a dryer cylinder group 1, whereupon the web

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What is claimed is:

1. Method for treating a moving web in a paper- or boardmaking machine, wherein

5

- forming a web on a moving wire,

- removing water from the web by pressing,

10

- drying the web by means of at least one dryer cylinder, and

15

- subjecting the web to surface treatment by means of at least one technique prior to the first dryer cylinder,

c h a r a c t e r i z e d in that

20

- arranging the web to travel supported by a transfer belt impervious to water during at least one treatment step prior to said first dryer cylinder.

25

2. Method according to claim 1, c h a r a c t e r - i z e d in that a web treatment substance is applied to the web surface during at least one treatment step prior to the first dryer cylinder and the web is arranged to travel supported by a transfer belt (9) so that the side of the web to which the treatment substance is applied is facing the transfer belt (9), whereby the treatment substance is pressed by means of the transfer belt onto the web.

30

35

3. Method according to claim 1, c h a r a c t e r - i z e d in that at least one side of the web is calendered against a transfer belt.

4. Method according to claim 1, c h a r a c t e r -

c h a r a c t e r i z e d in that at least two layers of treatment substance are applied at least to one side of the web during at least two separate web treatment steps.

5 23. Method according to any one of claims 1, 10, 22, c h a r a c t e r i z e d in that at least one layer of a web treatment substance is applied to the web by means of a film-transfer roll (21).

10 24. Method according to claim 1, c h a r a c t e r - i z e d by using a web treatment substance comprising surface size or coating mix in the form of a liquid, dispersion, emulsion or foam.

15 25. Method according to claim 1, c h a r a c t e r - i z e d in that the web is pressed against a roll by means of a transfer belt (9).

20 26. Assembly for a paper- or boardmaking machine, the assembly comprising

- a wire section (2, 3) for forming a moving web of paper or board,

25 - dryer means (4 - 14) for removing water from the web by pressing,

- at least one dryer cylinder (1) for drying the web, and

30 - at least one surface treatment device (S1A, S1B or SN) for treating the surface of the web prior to the first dryer cylinder (1),

35 c h a r a c t e r i z e d by

- at least one transfer belt (9) that is impervious

to water forming an endless loop against which the web is arranged to travel during a surface treatment step.

5 27. Assembly according to claim 26, c h a r a c t e r -
i z e d by means (S1A, S1B) for applying a treatment
substance to the web surface facing a transfer belt (9)
in a manner that causes the applied substance to be
pressed into the web by means of said belt (9).

10

28. Assembly according to claim 26 or 27, c h a r a c -
t e r i z e d in that at least one of a surface
treatment devices is a calender.

15 29. Assembly according to claim 26, c h a r a c t e r -
i z e d by

- a felt (14) adapted to travel against said
transfer belt (9) so that the web to be treated is
20 passed between the felt (14) and the transfer belt
(9), and

- at least one pressing means (13) for pressing the
felt (14) against the transfer belt (9) for removing
25 water from the web by pressing.

30 30. Assembly according to claim 29, c h a r a c t e r -
i z e d in that said pressing means is a shoe press
(13).

30

31. Assembly according to claim 29, c h a r a c t e r -
i z e d in that said pressing means is a roll (12).

35 32. Assembly according to claim 27, c h a r a c t e r -
i z e d by at least one noncontacting dryer means used
for drying the web prior to the first dryer cylinder.

33. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one felt (4), wire or belt (9) and
means (5) for picking the web off from a web-forming wire
(2) and passing the same supported by at least one felt
5 (4), wire or belt to the next belt (9), felt or wire.

34. Assembly according to claim 33, c h a r a c t e r -
i z e d by a wire (15) of a group (1) of dryer cylinders
and means (16) for picking the web off from said transfer
10 belt and passing the web at least partially supported by
said wire via said dryer cylinders (1).

35. Assembly according to claim 34, c h a r a c t e r -
i z e d by at least one felt (4) and at least one
15 transfer belt (9) for passing the web in a continuously
supported manner and in continuous connection with said
endless loop support means through a pressing dewatering
step.

20 36. Assembly according to claim 26, c h a r a c t e r -
i z e d by means for applying a web treatment substance
to the surface of the transfer belt, whereby said means
may comprise a film-transfer applicator, spray applica-
tor, jet applicator or short-dwell applicator device.

25 37. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one spray applicator device (S1A)
located within the area of the pressing dryer means for
applying a web treatment substance directly to the web or
30 into the nip defined between the web and the transfer
belt.

35 38. Assembly according to claim 26, c h a r a c t e r -
i z e d by a calibrating press (SN) located in front of
the dryer cylinders (1) or a calender through which the
web is adapted to pass.

39. Assembly according to claim 38, c h a r a c t e r -
i z e d in that the transfer belt (9) is adapted to pass
through the calibrating press.

5 40. Assembly according to claim 39, c h a r a c t e r -
i z e d by means (S2B) for applying a web treatment
substance on a roll (21) located on the exterior side of
the endless-loop transfer belt (9) of the calibrating
press (SN).

10

41. Assembly according to claim 38 or 39, c h a r a c -
t e r i z e d by a belt (36) adapted to pass as an
endless loop over said roll (21) located on the exterior
side of the endless-loop transfer belt (9) and by means
15 (S2) for applying a web treatment substance on the
surface of said belt (36).

42. Assembly according to claim 41, c h a r a c t e r -
i z e d in that said calibrating press (SN) comprises a
20 shoe press (37).

43. Assembly according to claim 26, c h a r a c t e r -
i z e d by

- 25 - at least two transfer belts (32, 36) adapted to
move at least a portion of their travel opposed to
each other so that the web is passed therebetween,
- 30 - means (S1, S2) for applying a web treatment
substance to the surfaces of the belts (32, 36), and
- means (20, 21) for pressing said belts (32, 36)
against each other for setting up an application
pressure.

35

44. Assembly according to any one of claims 26, 36, 37,
40, 43, c h a r a c t e r i z e d by at least one

noncontacting dryer such as a radiant heat dryer or air-impingement dryer serving to dry the web after the application of a web treatment substance.

5 45. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one film-transfer roll (21) for
applying a web treatment substance to the web surface.

10 46. Assembly according to claim 26, c h a r a c t e r -
i z e d in that at least one transfer belt is adapted to
pass over the roll in a manner permitting the web to be
pressed by means of the transfer belt against the roll.

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

SEPPO LAINE OY
Itämerenkatu 3 B
FIN-00180 Helsinki
FINLANDE

Date of mailing (day/month/year)
25 June 2001 (25.06.01)

Applicant's or agent's file reference
VAL 201 PCT

International application No.
PCT/FI00/00190

IMPORTANT NOTIFICATION

International filing date (day/month/year)
10 March 2000 (10.03.00)

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address

VALMET CORPORATION
Fabianinkatu 9 A
FIN-00130 Helsinki
Finland

State of Nationality

FI

State of Residence

FI

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☒ the name ☐ the address ☐ the nationality ☐ the residence

Name and Address

METSO PAPER, INC.
Fabianinkatu 9 A
FIN-00130 Helsinki
Finland

State of Nationality

State of Residence

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

☒ the receiving Office ☐ the designated Offices concerned
☐ the International Searching Authority ☒ the elected Offices concerned
☒ the International Preliminary Examining Authority ☐ other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

J. Leitao

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

SEPPO LAINE OY
Itämerenkatu 3 B
FIN-00180 Helsinki
FINLANDE

Date of mailing (day/month/year) 25 June 2001 (25.06.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference VAL 201 PCT	
International application No. PCT/FI00/00190	International filing date (day/month/year) 10 March 2000 (10.03.00)

1. The following indications appeared on record concerning:	
<input checked="" type="checkbox"/> the applicant	<input type="checkbox"/> the inventor
<input type="checkbox"/> the agent	<input type="checkbox"/> the common representative
Name and Address VALMET CORPORATION Fabianinkatu 9 A FIN-00130 Helsinki Finland	State of Nationality FI
	State of Residence FI
	Telephone No.
	Facsimile No.
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:	
<input type="checkbox"/> the person	<input checked="" type="checkbox"/> the name
<input type="checkbox"/> the address	<input type="checkbox"/> the nationality
<input type="checkbox"/> the residence	
Name and Address METSO PAPER, INC. Fabianinkatu 9 A FIN-00130 Helsinki Finland	State of Nationality
	State of Residence
	Telephone No.
	Facsimile No.
3. Further observations, if necessary:	
4. A copy of this notification has been sent to:	
<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input checked="" type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer J. Leitaio
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 18 October 2000 (18.10.00)	
International application No. PCT/FI00/00190	Applicant's or agent's file reference VAL 201 PCT
International filing date (day/month/year) 10 March 2000 (10.03.00)	Priority date (day/month/year) 12 March 1999 (12.03.99)
Applicant KORHONEN, Hannu et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
28 August 2000 (28.08.00)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer R. E. Stoffel</p> <p>Telephone No.: (41-22) 338.83.38</p>
--	---

The demand must be filed directly with the competent International Preliminary Examining Authority, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IEPA/ SE

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:
The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only	
Identification of IEPA	Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION	
Applicant's or agent's file reference VAL 201 PCT	
International application No. PCT/FI00/00190	International filing date (day/month/year) 10 March 2000
(Earliest) Priority date (day/month/year) 12 March 1999	
Title of invention Method and apparatus for handling a paper or board web	
Box No. II APPLICANT(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
VALMET CORPORATION Fabianinkatu 9 A FIN-00130 Helsinki Finland	
Telephone No.:	
Facsimile No.:	
Teleprinter No.:	
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
KORHONEN, Hannu Hollituvantie 23 FIN-40200 Jyväskylä Finland	
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
RANTANEN, Rauno Oksalanmäki FIN-40950 Muurame Finland	
State (that is, country) of nationality: Finland	State (that is, country) of residence: Finland
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.	

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*SEPPÖ LAINE OY
Itämerenkatu 3 B
FIN-00180 Helsinki
Finland

Telephone No.:

+358-9-68 59 560

Facsimile No.:

+358-9-68 595 610

Teleprinter No.:

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☐ as originally filed☐ as amended under Article 34the claims ☐ as originally filed☐ as amended under Article 19 (together with any accompanying statement)☐ as amended under Article 34the drawings ☐ as originally filed☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English☐ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☒ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (<i>specify</i>) | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (<i>specify</i>): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

For the Applicants

Seppo Laine Oy

Simo Hovi

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

TENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference VAL 201 PCT	FOR FURTHER ACTION		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/FI00/00190	International filing date (<i>day/month/year</i>) 10.03.2000	Priority date (<i>day/month/year</i>) 12.03.1999	
International Patent Classification (IPC) or national classification and IPC ₇ D 21 H 23/28			
Applicant Valmet Corporation et al			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 28.08.2000	Date of completion of this report 28.06.2001
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer Barbro Nilsson/ELY Telephone No. 08-782 25 00

I. Basis of the report**1. With regard to the elements of the international application:***

- ☐ the international application as originally filed
- ☒ the description:
pages 1-8, 10-16, as originally filed
pages _____, filed with the demand
pages 9, filed with the letter of 19.04.2001
- ☒ the claims:
pages 18-20, as originally filed
pages _____, as amended (together with any statement) under article 19
pages _____, filed with the demand
pages 17, 21-25, filed with the letter of 19.04.2001
- ☒ the drawings:
pages 1-7, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____
- ☐ the sequence listing part of the description:
pages _____, as originally filed
pages _____, filed with the demand
pages _____, filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language English which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☒ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages _____
- ☐ the claims, Nos. _____
- ☐ the drawings, sheet/fig _____

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2 (c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item I and annexed to this report.

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00190

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-46</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-46</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-46</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The present invention relates to a method and an assembly for coating or surface sizing webs of paper and board.

It is an object of the invention to provide a method for surface treating a web of paper or board prior to the cylinder dryer section while the solids content of the web is low. The goal of the invention is achieved by way of passing the web supported by a transfer belt through at least one surface treatment section such as a coater station.

New independent claims 1 and 26 have been filed with the letter of 19 April 2001. The feature that the transfer belt is impervious to water has been included in the claims. An important feature with a water impervious transfer surface is that water cannot move towards the treated surface, but is pressed in the web.

Relevant documents cited in the International Search Report:

D1 EP 0881329 A2

D2 US 5575891 A

D1 discloses a method of applying a suspension onto the surface of a wet paper web that is supported by a felt (5a). The surface treatment is performed prior to the drying section of dryer cylinders.

D2 discloses a method of surface treating a web of wet tissue paper prior to drying of the paper web. A distributing roll (21) distributes an emulsion onto a papermaking belt (10), which supports the paper web. The emulsion is transferred from the belt to the web with aid of a vacuum pickup shoe (24a).

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI00/00190

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

The transfer belt in the invention differs from the felt (5a) in D1, and the papermaking belt (10) in D2, in that it is impervious and thus works in a different way than that in D1 and D2. In D1 the paper web is supported by a felt, which is pervious. Even if D2 cites a belt, which usually means an impermeable material, it is clear from the way it works that it is porous. Thus, none of the documents disclose the use of an impervious transfer belt, which is a characteristic feature of the invention.

Therefore, the claimed invention is novel, considered to involve an inventive step and have industrial applicability.

is metered and the size is smoothed on the belt surface by means of a rod or blade.

As is shown in FIG. 1, the applicator devices S1A and S1B
5 can be used alternatively or even simultaneously when a large amount of surface size has to be applied to the same surface of the web. Next, the transfer belt 9 with the web travelling thereon is passed into a nip between a deflecting backing roll 11 and a press roll 12, wherein
10 water is removed from the web toward the first felt 4. The transfer belt 9 with the web running thereon passes over the deflecting backing roll 11. In the illustrated embodiment, a shoe press 13 adapted to operate against the deflecting backing roll 11 over which a belt or the
15 felt 14 is adapted to pass. In order to apply surface size to the untreated side of the web, this embodiment has a spray applicator S2 adapted at a point along the web passage between the nip of the press roll 12 and its backing roll 11 and the nip between the shoe press 13 and
20 its backing roll. In this arrangement, the first coated side of the web will face the belt 14 that runs over the shoe press 13. If the nip of the shoe press is adapted to have a transfer belt on both sides thereof, no dewatering takes place in the nip, but rather, the press acts as a
25 calender that smooths the web surface.

From the shoe press 13, the web travels on the transfer belt 9 out from the shoe press nip. The web is picked from the transfer belt 9 onto the dryer wire 15 of the
30 dryer cylinder group by a third suction roll 16. Adherence of the web to the felt is secured by means of a suction box 17, and the final drying of the web is carried out by means a dryer cylinder group 1, whereupon the web

What is claimed is:

1. Method for treating a moving web in a paper- or boardmaking machine, wherein

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- forming a web on a moving wire,

- removing water from the web by pressing,

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- drying the web by means of at least one dryer cylinder, and

- subjecting the web to surface treatment by means of at least one technique prior to the first dryer cylinder,

15

c h a r a c t e r i z e d in that

20

- arranging the web to travel supported by a transfer belt impervious to water during at least one treatment step prior to said first dryer cylinder.

25

2. Method according to claim 1, c h a r a c t e r - i z e d in that a web treatment substance is applied to the web surface during at least one treatment step prior to the first dryer cylinder and the web is arranged to travel supported by a transfer belt (9) so that the side of the web to which the treatment substance is applied is facing the transfer belt (9), whereby the treatment substance is pressed by means of the transfer belt onto the web.

30

3. Method according to claim 1, c h a r a c t e r - i z e d in that at least one side of the web is calendered against a transfer belt.

35

4. Method according to claim 1, c h a r a c t e r -

c h a r a c t e r i z e d in that at least two layers of treatment substance are applied at least to one side of the web during at least two separate web treatment steps.

5 23. Method according to any one of claims 1, 10, 22, c h a r a c t e r i z e d in that at least one layer of a web treatment substance is applied to the web by means of a film-transfer roll (21).

10 24. Method according to claim 1, c h a r a c t e r - i z e d by using a web treatment substance comprising surface size or coating mix in the form of a liquid, dispersion, emulsion or foam.

15 25. Method according to claim 1, c h a r a c t e r - i z e d in that the web is pressed against a roll by means of a transfer belt (9).

20 26. Assembly for a paper- or boardmaking machine, the assembly comprising

- a wire section (2, 3) for forming a moving web of paper or board,

25 - dryer means (4 - 14) for removing water from the web by pressing,

- at least one dryer cylinder (1) for drying the web, and

30

- at least one surface treatment device (S1A, S1B or SN) for treating the surface of the web prior to the first dryer cylinder (1),

35 c h a r a c t e r i z e d by

- at least one transfer belt (9) that is impervious

to water forming an endless loop against which the web is arranged to travel during a surface treatment step.

5 27. Assembly according to claim 26, c h a r a c t e r -
i z e d by means (S1A, S1B) for applying a treatment
substance to the web surface facing a transfer belt (9)
in a manner that causes the applied substance to be
pressed into the web by means of said belt (9).

10

28. Assembly according to claim 26 or 27, c h a r a c -
t e r i z e d in that at least one of a surface
treatment devices is a calender.

15 29. Assembly according to claim 26, c h a r a c t e r -
i z e d by

- a felt (14) adapted to travel against said
transfer belt (9) so that the web to be treated is
20 passed between the felt (14) and the transfer belt
(9), and

- at least one pressing means (13) for pressing the
felt (14) against the transfer belt (9) for removing
25 water from the web by pressing.

30 30. Assembly according to claim 29, c h a r a c t e r -
i z e d in that said pressing means is a shoe press
(13).

31. Assembly according to claim 29, c h a r a c t e r -
i z e d in that said pressing means is a roll (12).

35 32. Assembly according to claim 27, c h a r a c t e r -
i z e d by at least one noncontacting dryer means used
for drying the web prior to the first dryer cylinder.

33. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one felt (4), wire or belt (9) and
means (5) for picking the web off from a web-forming wire
(2) and passing the same supported by at least one felt
5 (4), wire or belt to the next belt (9), felt or wire.

34. Assembly according to claim 33, c h a r a c t e r -
i z e d by a wire (15) of a group (1) of dryer cylinders
and means (16) for picking the web off from said transfer
10 belt and passing the web at least partially supported by
said wire via said dryer cylinders (1).

35. Assembly according to claim 34, c h a r a c t e r -
i z e d by at least one felt (4) and at least one
15 transfer belt (9) for passing the web in a continuously
supported manner and in continuous connection with said
endless loop support means through a pressing dewatering
step.

20 36. Assembly according to claim 26, c h a r a c t e r -
i z e d by means for applying a web treatment substance
to the surface of the transfer belt, whereby said means
may comprise a film-transfer applicator, spray applica-
tor, jet applicator or short-dwell applicator device.

25 37. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one spray applicator device (S1A)
located within the area of the pressing dryer means for
applying a web treatment substance directly to the web or
30 into the nip defined between the web and the transfer
belt.

38. Assembly according to claim 26, c h a r a c t e r -
i z e d by a calibrating press (SN) located in front of
35 the dryer cylinders (1) or a calender through which the
web is adapted to pass.

39. Assembly according to claim 38, c h a r a c t e r -
i z e d in that the transfer belt (9) is adapted to pass
through the calibrating press.

5 40. Assembly according to claim 39, c h a r a c t e r -
i z e d by means (S2B) for applying a web treatment
substance on a roll (21) located on the exterior side of
the endless-loop transfer belt (9) of the calibrating
press (SN).

10 41. Assembly according to claim 38 or 39, c h a r a c -
t e r i z e d by a belt (36) adapted to pass as an
endless loop over said roll (21) located on the exterior
side of the endless-loop transfer belt (9) and by means
15 (S2) for applying a web treatment substance on the
surface of said belt (36).

42. Assembly according to claim 41, c h a r a c t e r -
i z e d in that said calibrating press (SN) comprises a
20 shoe press (37).

43. Assembly according to claim 26, c h a r a c t e r -
i z e d by

25 - at least two transfer belts (32, 36) adapted to
move at least a portion of their travel opposed to
each other so that the web is passed therebetween,

30 - means (S1, S2) for applying a web treatment
substance to the surfaces of the belts (32, 36), and

- means (20, 21) for pressing said belts (32, 36)
against each other for setting up an application
pressure.

35

44. Assembly according to any one of claims 26, 36, 37,
40, 43, c h a r a c t e r i z e d by at least one

noncontacting dryer such as a radiant heat dryer or air-impingement dryer serving to dry the web after the application of a web treatment substance.

5 45. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one film-transfer roll (21) for
applying a web treatment substance to the web surface.

10 46. Assembly according to claim 26, c h a r a c t e r -
i z e d in that at least one transfer belt is adapted to
pass over the roll in a manner permitting the web to be
pressed by means of the transfer belt against the roll.

PCT REQUEST

VAL 201 PCT

Original (for **SUBMISSION**) - printed on 10.03.2000 10:34:48 AM

0	For receiving Office use only	
0-1	International Application No.	
0-2	International Filing Date	
0-3	Name of receiving Office and "PCT International Application"	
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.90 (updated 15.12.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	VAL 201 PCT
I	Title of invention	METHOD AND APPARATUS FOR HANDLING A PAPER OR BOARD WEB
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	VALMET CORPORATION
II-5	Address:	Fabianinkatu 9 A FIN-00130 Helsinki Finland
II-6	State of nationality	FI
II-7	State of residence	FI
II-8	Telephone No.	+358-020 484 100
II-9	Facsimile No.	+358-020 484 101
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	KORHONEN, Hannu
III-1-5	Address:	Hollituvantie 23 FIN-40200 Jyväskylä Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

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III-2	Applicant and/or inventor	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	RANTANEN, Rauno
III-2-5	Address:	Oksalanmäki FIN-40950 Muurame Finland
III-2-6	State of nationality	FI
III-2-7	State of residence	FI
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	SEPPO LAINE OY
IV-1-2	Address:	Itämerenkatu 3 B FIN-00180 Helsinki Finland
IV-1-3	Telephone No.	+358-9-68 59 560
IV-1-4	Facsimile No.	+358-9-68 595 610
IV-1-5	e-mail	seppo.laine@selpat.fi
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT

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V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT (patent and utility model) AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW	
V-3	National Patent (States which have become party to the PCT after the issuance of this version of EASY)	DZ Algeria	
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	Exclusion(s) from precautionary designations	NONE	
VI-1	Priority claim of earlier national application		
VI-1-1	Filing date	12 March 1999 (12.03.1999)	
VI-1-2	Number	990557	
VI-1-3	Country	FI	
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1	
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)	
VIII	Check list	number of sheets	electronic file(s) attached
VIII-1	Request	4	-
VIII-2	Description	16	-
VIII-3	Claims	9	-
VIII-4	Abstract	1	val201.txt
VIII-5	Drawings	7	-
VIII-7	TOTAL	37	

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	Accompanying items	paper document(s) attached	electronic file(s) attached
VIII-8	Fee calculation sheet	✓	-
VIII-16	PCT-EASY diskette	-	diskette
VIII-17	Other (specified):	Copy of official action	-
VIII-18	Figure of the drawings which should accompany the abstract	1	
VIII-19	Language of filing of the international application	Finnish	
IX-1	Signature of applicant or agent		
IX-1-1	Name	SEPPO LAINE OY	
IX-1-2	Name of signatory	Simo Hovi	

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10-1	Date of actual receipt of the purported international application	
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	
10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

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11-1	Date of receipt of the record copy by the International Bureau	
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0	For receiving Office use only	
0-1	International Application No.	PCT/FI 00 / 00190
0-2	International Filing Date	10 MAR 2000 (10-03-2000)
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4	Form - PCT/RO/101 PCT Request	
0-4-1	Prepared using	PCT-EASY Version 2.90 (updated 15.12.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
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0-7	Applicant's or agent's file reference	VAL 201 PCT
I	Title of invention	METHOD AND APPARATUS FOR HANDLING A PAPER OR BOARD WEB
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
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II-9	Facsimile No.	+358-020 484 101
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	KORHONEN, Hannu
III-1-5	Address:	Hollituvantie 23 FIN-40200 Jyväskylä Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI

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III-2	Applicant and/or inventor	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	RANTANEN, Rauno
III-2-5	Address:	Oksalanmäki FIN-40950 Muurame Finland
III-2-6	State of nationality	FI
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IV-1-1	Name	SEPPO LAINE OY
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IV-1-3	Telephone No.	+358-9-68 59 560
IV-1-4	Facsimile No.	+358-9-68 595 610
IV-1-5	e-mail	seppo.laine@selpat.fi
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ TZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT

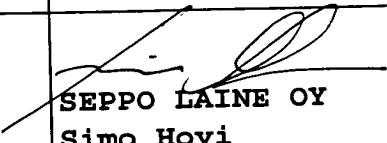
PCT REQUEST

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V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT (patent and utility model) AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) DM EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MA MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW	
V-3	National Patent (States which have become party to the PCT after the issuance of this version of EASY)	DZ Algeria	
V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.		
V-6	Exclusion(s) from precautionary designations	NONE	
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VIII-5	Drawings	7	-
VIII-7	TOTAL	37	

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	Accompanying items	paper document(s) attached	electronic file(s) attached
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VIII-19	Language of filing of the international application	Finnish	
IX-1	Signature of applicant or agent		
IX-1-1	Name	SEPPÖ LAINE OY	
IX-1-2	Name of signatory	Simo Hovi	

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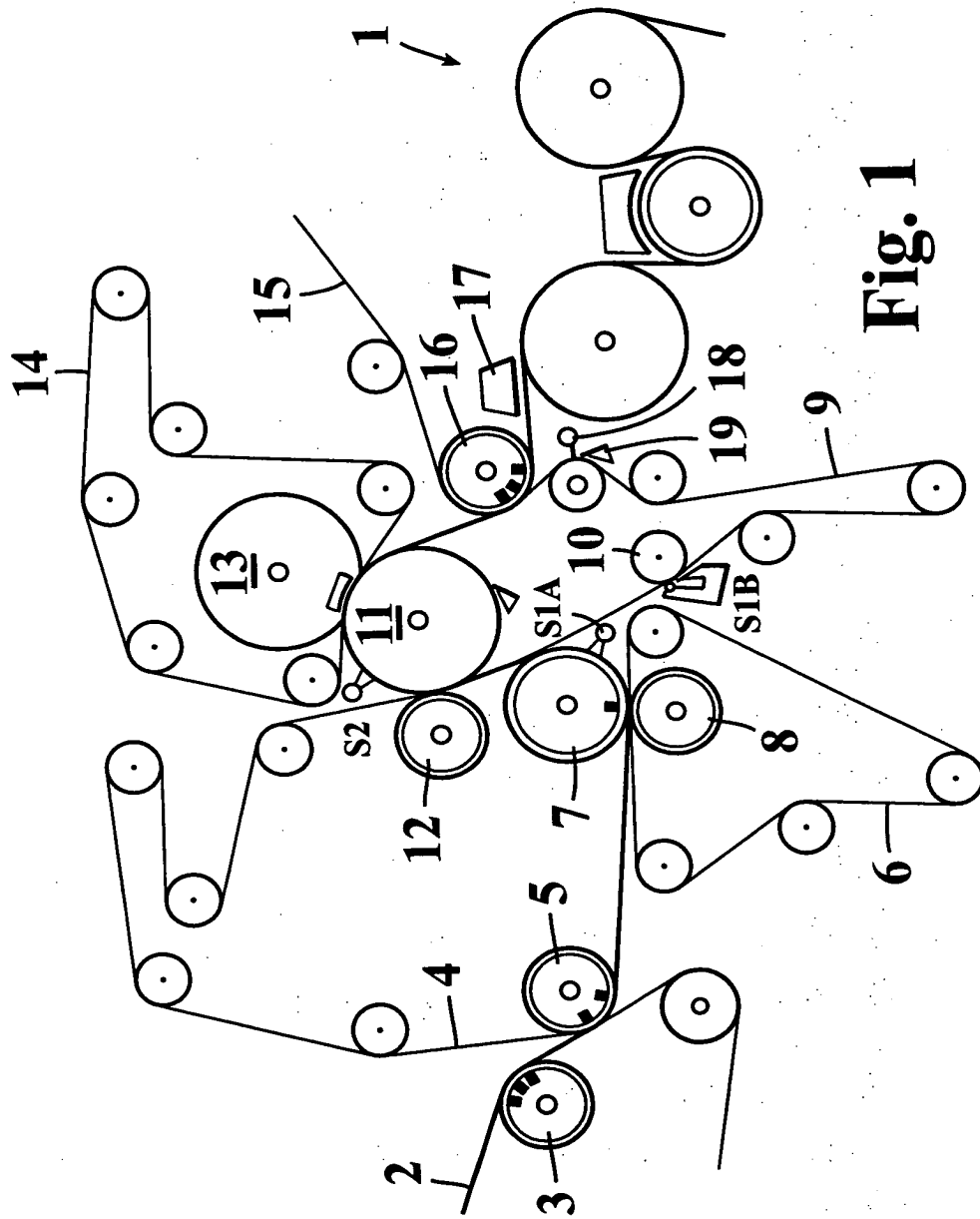


Fig. 1

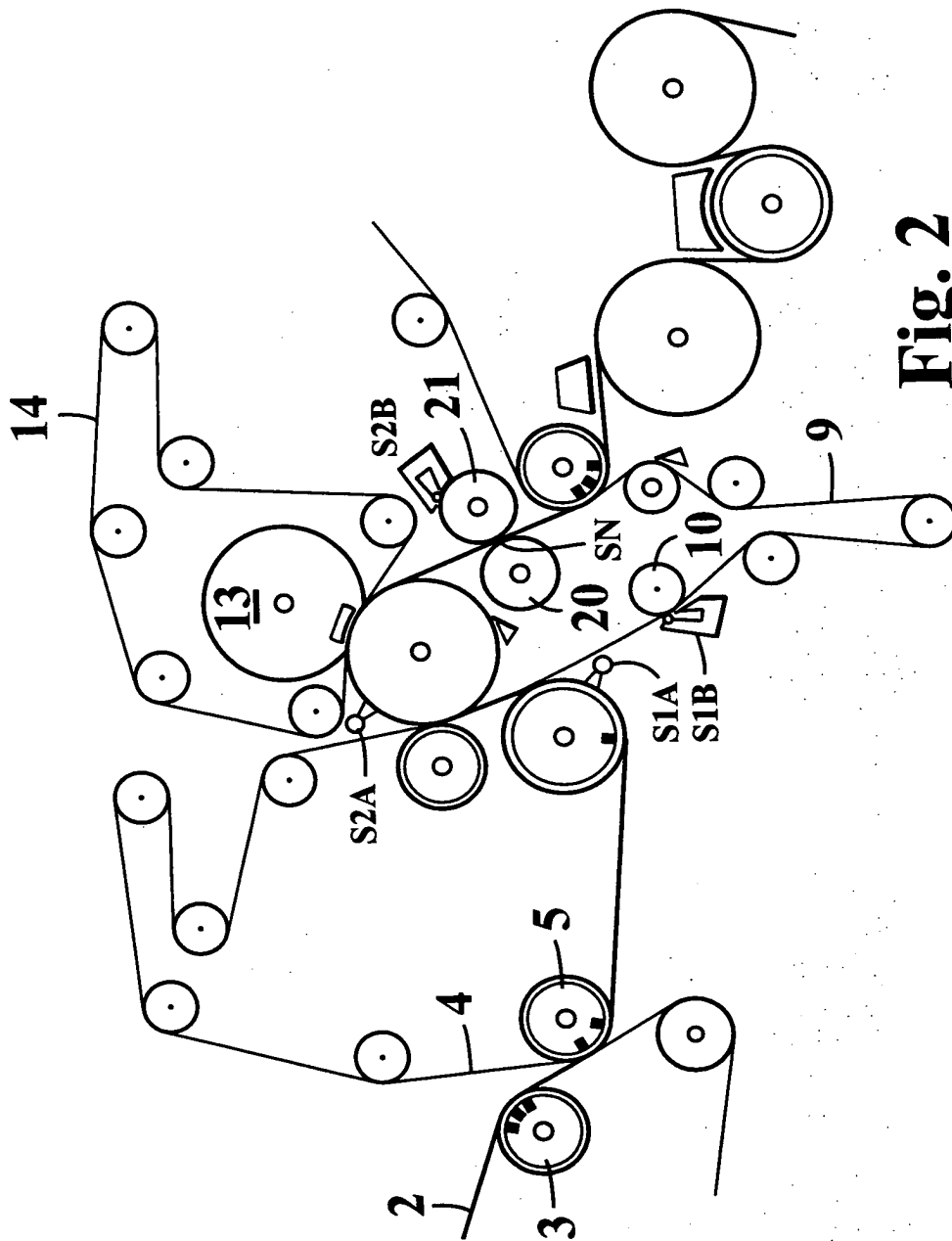


Fig. 2

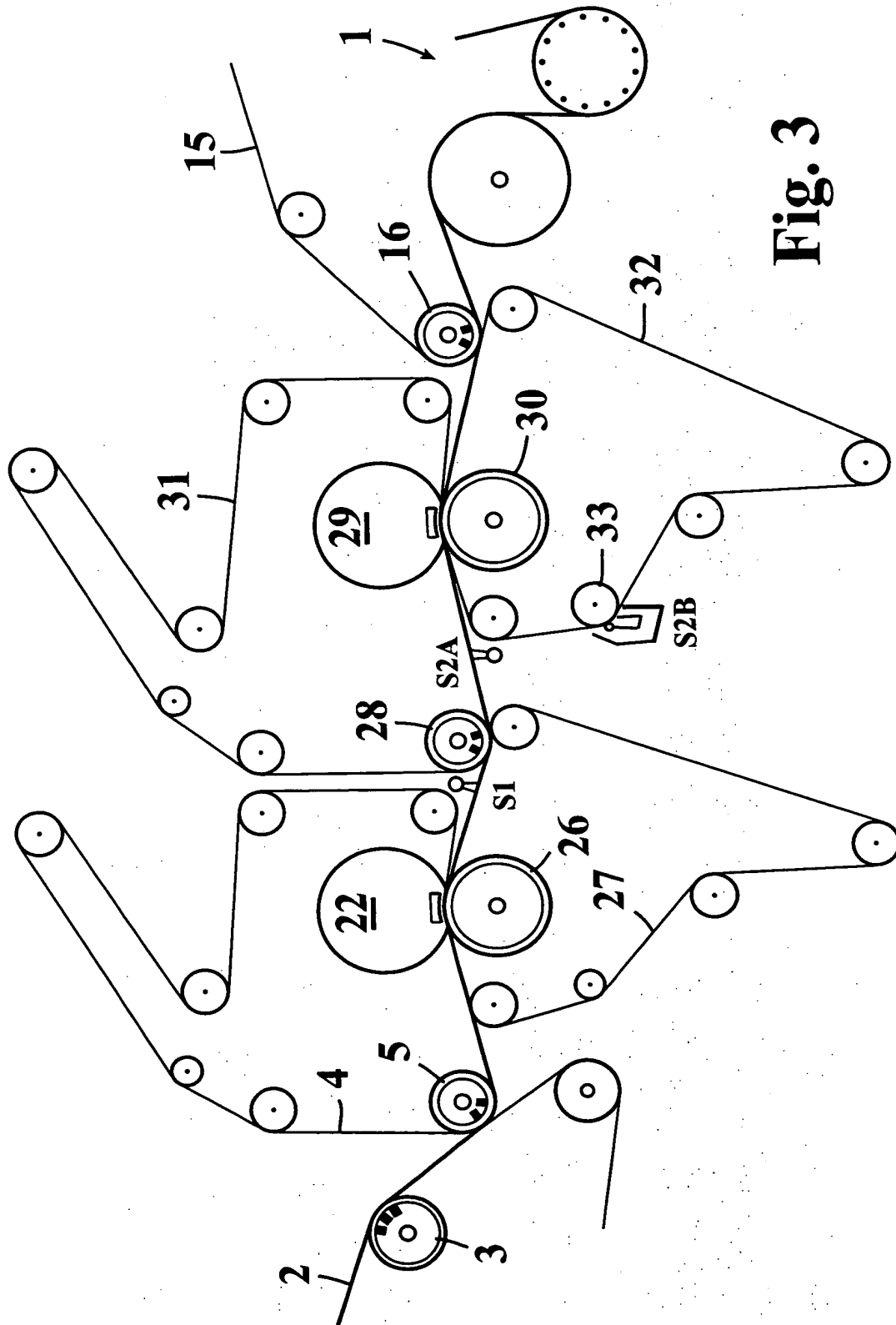


Fig. 3

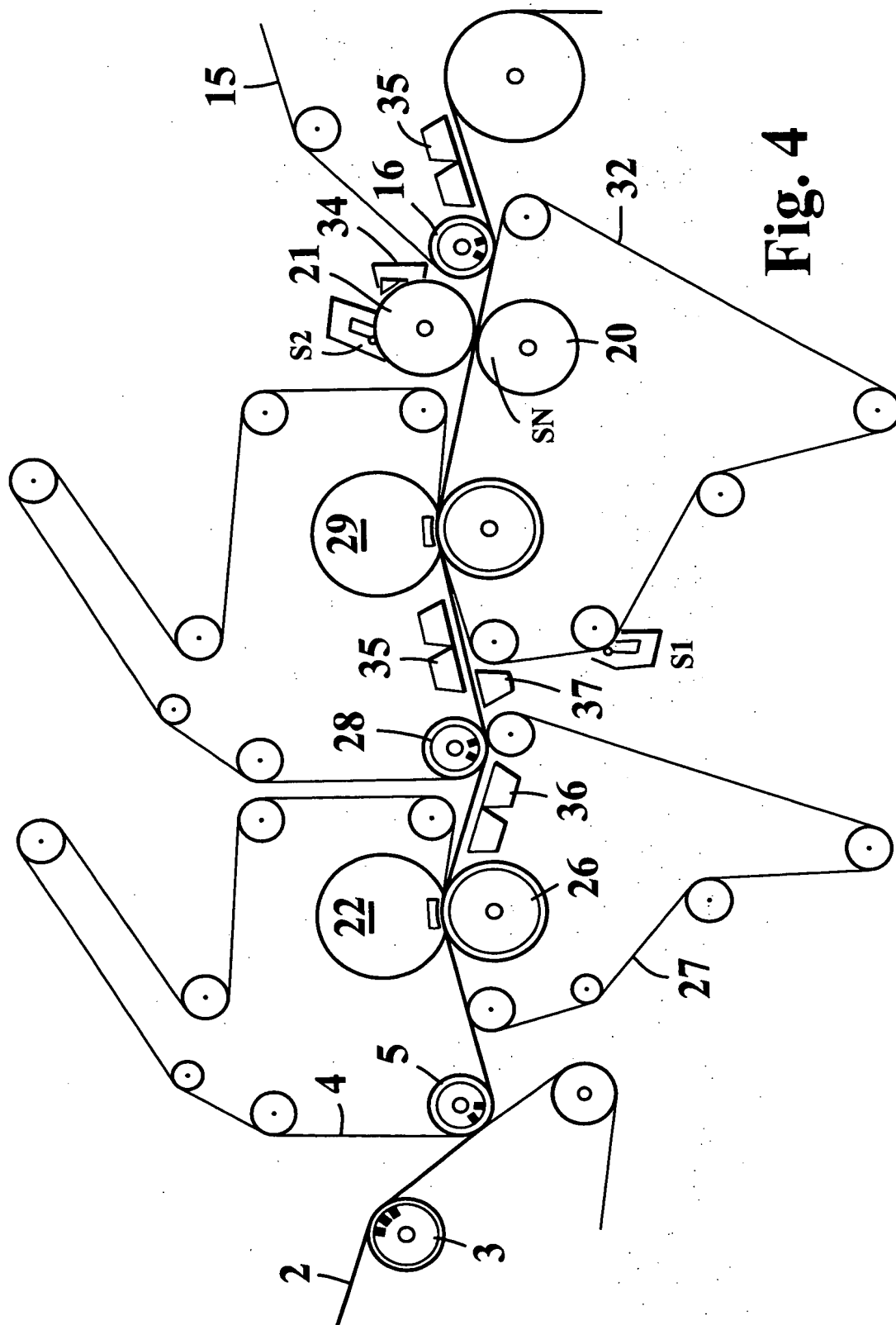


Fig. 4



Fig. 5

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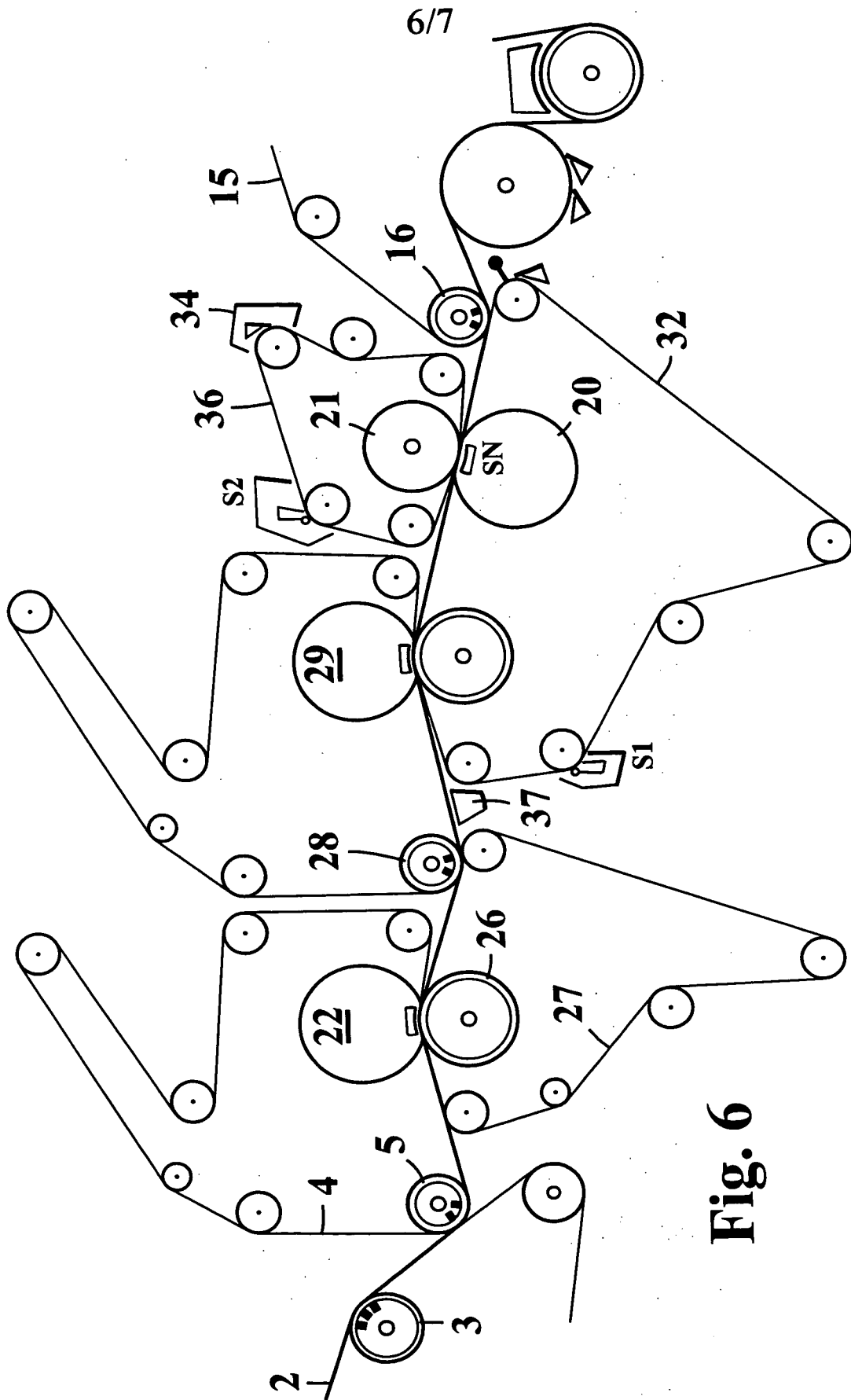


Fig. 6

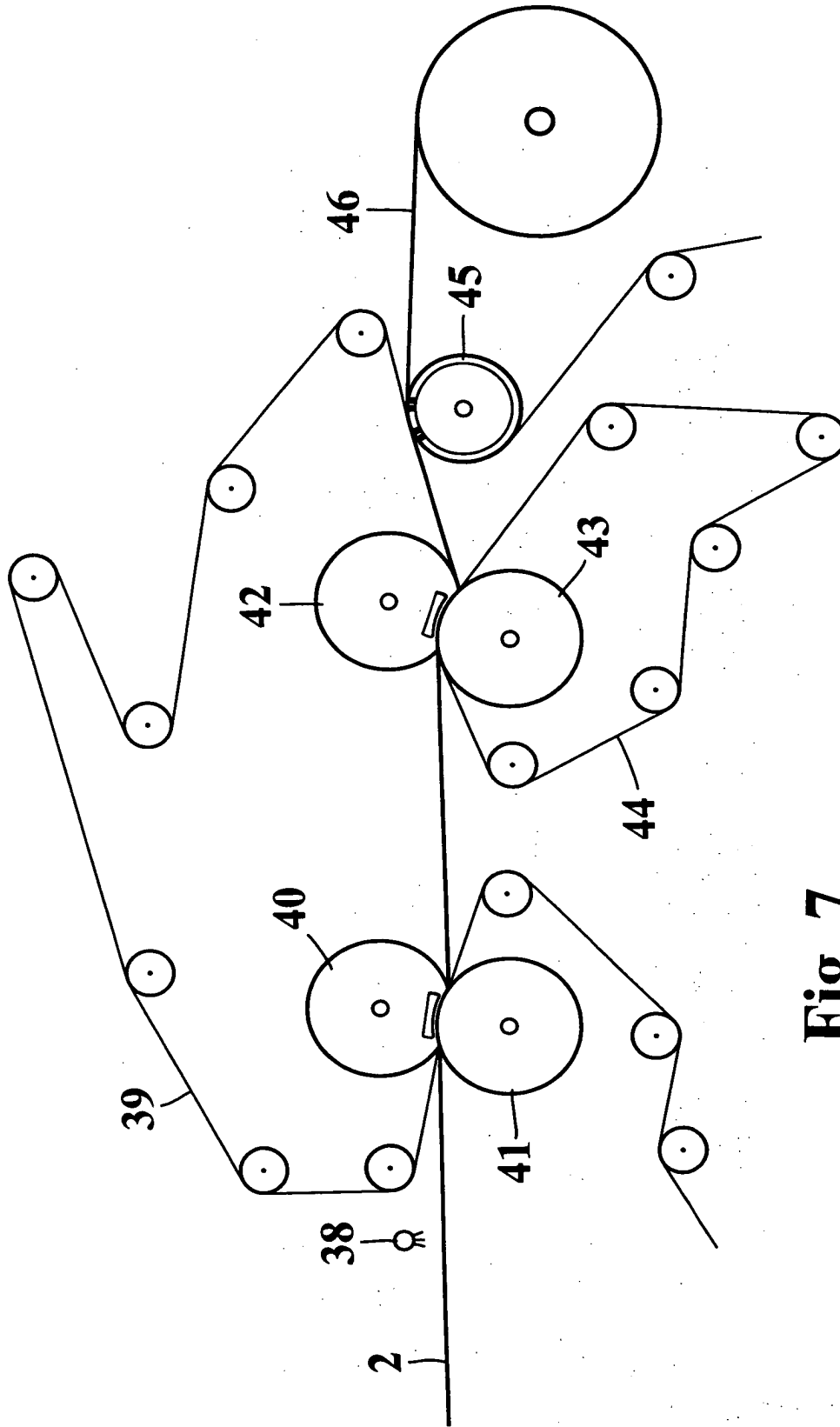


Fig. 7

Menetelmä ja sovitelma paperi- ja kartonkirainan käsittelymiseksi

- 5 Tämän keksinnön kohteena on patenttivaatimuksen 1 johdannon mukainen menetelmä paperi- ja kartonkirainojen päällystämiseksi tai pintaliimaamiseksi niiden painettavuuden, lujuuden tai muiden ominaisuuksien parantamiseksi.
- 10 Keksinön kohteena on myös menetelmän soveltamiseen tarkoitettu sovitelma.

Paperin tai kartongin ominaisuuksien parantamiseksi pohjapaperi- tai kartonkirainaa käsitellään eri tavoin. Käsittelyjen tarkoituksena on parantaa valmistettavan materiaalin
15 lujuus- tai painettavuusominaisuuksia. Lujuuden lisäämiseen käytetään ensisijaisesti pintaliimausta, jossa rainan pintaan levitetään rainan lujuutta lisäävää liimamaista ainetta, esimerkiksi tärkkelysliuosta. Päällystystä käytetään
20 muun muassa materiaalin vaaleuden, tiiviyyden tai sileyden parantamiseen ja kalanterointia sileyden ja kiillon parantamiseen.

Tavallisesti rainan käsittely tehdään pohjarainan valmistamisen jälkeen kuivalle radalle joko erillisillä off-line
25 laitteilla tai suoraan paperi- tai kartonkikoneen perään liitetyillä on-line laitteilla. Tällöin raina on kuivattu ainakin oleellisesti lähelle loppukuivuuttaan ja erityisesti pintaliimauksessa ja päällystyksessä rainaa joudutaan
30 kastelemaan ja uudelleen kuivaamaan, mikä lisää koneen pirtuutta ja energian kulutusta. Koska paperi- ja kartonkikoneilla on valmiina tehokkaat vedenpoisto- ja kuivatuslait-

teet, olisi edullista siirtää rainaa kastelevat toimenpiteet kuten pintaliimaus ja päällystys mahdollisimman lähelle perälaatikkoa viiraosalle tai puristinosalle, jolloin pohjarainan ja käsittelyaineen vedenpoisto ja kuivatus voidaan tehdä ainakin osittain samanaikaisesti. Puristin- tai viiraosalla tapahtuvalla pintaliimauksella ja päällystyksellä saavutettaisiin myös huomattavia laatuetaoja koska pintakäsittelyaineen siirtyminen radassa on erilaista kuin levitettäessä kostuttavaa käsittelyainetta jo kuivatulle radalle. Kalanteroinnin vaikutus tehostuu, jos käsiteltävän rainan kosteus on suurempi, joten kalanteroinninkin siirtäminen paperi- tai kartonkikoneen puristinosalle parantane kalanterointitulosta useimmilla paperi- ja kartonkilajeilla.

Siihen, että pohjarainan valmistus ja jälkikäsittely on tehty erillisissä vaiheissa on kaksi pääasiallista syytä. Ensinnäkin pohjarainan valmistus ja jälkikäsittely on perinteisesti käsitetty hyvin voimakkaasti erillisiksi työvaiheiksi, jotka on toteutettu toisistaan riippumatta. Toiseksi, erityisesti paperiradat ja jopa kartonkiradat ovat hyvin heikkoja ennen kuin ne on kuivattu lähelle lopullista kuiva-ainepitoisuutta, joten rainaa kostuttavia toimenpiteitä ei ole voitu tehdä ajettavuutta vaarantamatta.

Tekniikan tasosta tunnetaan ratkaisu, jossa pintaliimaus tehdään filminsiirtopäällystymellä. Filminsiirtopäällystymessä pyörivän filminsiirtotelan pinnalle tarkasti annosteltu päällystefilmi siirtyy telalta rainan pinnalle. Vaikka filminsiirtopäällystimen ajettavuus on erittäin hyvä eikä käsittely rasita voimakkaasti rainaa, raina heikkenee kuitenkin siihen imeytyvän veden vaikutuksesta. Koska rai-

nä ei siirretä suoraan filminsiirtotelalta tukielimelle, esimerkiksi viiralle, filminsiirtotelan ja seuraavan tukielimen välille syntyy avoin tukematon väli. Rainassa esiintyy aina poikittaissuuntaisia ja erityisesti koneen suuntaisia rainajännityksiä. Rainaan saattaa syntyä esimerkiksi kosteusprofiilin poikkeamien takia jännityshuippuja, jotka katkaisevat märän ja heikon rainan helposti.

10 Filminsiirtopäällystyksen lisäksi on ehdotettu käytettäväksi spraypäällystystä, jossa pintaliima tai päällyste levitetään radalle useilla rinnakkain ja/tai peräkkäin sijoituilla spraysuuttimilla.

15 Yhdysvaltalaisessa patentissa 3,146,159 on kuvattu ratkaisu, jossa päällystys tehdään märkään rainaan siten, että paperi päällystetään toiselta puoleltaan ja sitä tuetaan päällystyksen aikana huovalla. Päällystys tasauspuristimella on myös mainittu.

20 Yhdysvaltalaisessa patentissa 4,793,899 on käytetty spray- ja lyhytviipymäpäällystystekniikoita ja rainan tuenta on edellä mainitussa patentissa kuvattua ratkaisua kehittyneempi, mutta tässäkin ratkaisussa on avoimia vientejä ja päällystys tehdään huovan tukemana.

25 Edelleen Yhdysvaltalaisessa patentissa 5,152,872 on kuvattu ratkaisu, jossa ei ole enää avoimia välejä. Tässä ratkaisussa päällyste applikoidaan telojen pinnoille ja niiltä suoraan radalle ja päällystysnipissä on edelleen huopa.

30 Tämän keksinnön tarkoituksena on saada aikaan menetelmä, jonka avulla paperi- tai kartonkirainaa voidaan käsitellä

kostuttavalla aineella tai kalanteroida ennen paperi- tai kartonkikoneen sylinterikuivatusosaa rainan kuiva-
ainepitoisuuden ollessa hyvin alhainen, tyypillisesti 10 - 60%.

5

Edelleen keksinnön tarkoituksena on saada aikaan menetelmä, jonka avulla raina voidaan kuljettaa täysin tuettuna paperi- tai kartonkikoneen viiraosalta haluttaessa aina kiinnirullaimelle saakka ja samalla hyödyntää rainan kosteuspi-
10 toisuuden ja kosteuden hallitun siirtymisen mahdollistamia laatuettuja.

Keksintö perustuu siihen, että raina kuljetetaan siirtohihnan tukemana ainakin yhden pintakäsittelylaitteen, kuten
15 päällystysaseman tai kalanterin kautta ennen sen viemistä paperi- tai kartonkikoneen ensimmäiselle kuivainsylinteriryhmälle.

Keksinnön yhden edullisen suoritusmuodon mukaan ainakin yhdessä siirtohihnan tukemassa nipissä poistetaan vettä samanaikaisesti kuin käsittelyainetta siirretään rainaan.
Vettä poistava nippi voi muodostua siirtohihnasta ja viiraosan viirasta tai puristinosan huovasta. Yksinkertaisuuden vuoksi määritellään, että vedenpoisto siirtohihnan ja viiran
25 muodostamassa nipissä on osa puristinosaa, jolloin seuraavassa puristinosan nippi voi olla myös viiran ja siirtohihnan välinen nippi.

Täsmällisemmin sanottuna keksinnön mukaiselle menetelmälle
30 on tunnusomaista se, mitä on esitetty patenttivaatimuksen 1 tunnusmerkkiosassa.

Keksinnön mukaiselle sovitelmalle on puolestaan tunnusomaista se, mitä on esitetty patenttivaatimuksen 26 tunnusmerkkiosassa.

5 Keksinnön avulla saavutetaan huomattavia etuja.

Yksi keksinnön tärkeimmistä eduista on se, että päällystettyä tai pintaliimattua kartonkia tai paperia voidaan valmistaa huomattavasti yksinkertaisemmalla ja lyhyemmällä koneella, koska rainan pintakäsittely ja kuivaaminen voidaan tehdä samassa tai lähes samassa tilassa ja samoin laittein kuin vedenpoisto puristinosalla ja kuivaus on aikaisemmin tehty. Laitteisto koostuu pääosin olemassa olevista komponenteista. Jos laitteessa käytetään kalanterointia, se voidaan tehdä valmistettavan paperilaadun kannalta edullisimmassa paikassa rainan kosteuden ja muokkautuvuuden suhteen. Kuivauksen hyötysuhde paranee, koska kuivatus tehdään vain yhden kerran eikä kostuteta jo kerran kuivattua rainaa. Vettä on myös halvempaa poistaa hyvin kosteasta radasta kuin kuivasta radasta. Jos pintaliimaus tai päällystys tehdään esimerkiksi puristinosan nipissä siten, että rainaa tukee päällystettävällä puolella siirtohihna ja vastakkaisella puolella huopa tai viira, radasta poistuu vettä viiraa tai huopaa kohti ja käsittelyaine tunkeutuu rainaan.

25 Parhaassa tapauksessa käsittelyaineen sisältämä vesimäärä poistuu nipissä kokonaisuudessaan vaatimansa tilavuuden pakkottamana määrästä rainasta huopaan eikä raina kuivatustarve kasva. Puristinnippi voi myös toimia tasoituspuristimenä ja siis kalanterina ja tasoittaa rainan pintaa. Tällä tavoin

30 voidaan päästä jopa niin hyvään sileyteen, että keksinnön avulla voidaan valmistaa laadultaan riittävästi softkalanteroituja laatuja vastaavaa paperia tai kartonkia. Sekä ve-

den siirtoa ja poistumista ja kalanterointivaikutusta voidaan vahvistaa kuumentamalla siirtohihnaa tai sitä tukevaa telaa. Kuumennettavan hihnan avulla voidaan tehdä rainan lämpöprofilointia, jolla voidaan vaikuttaa esimerkiksi rainan kosteus- tai sileysprofiiliin. Kosteusprofiileihin voidaan vaikuttaa myös liimamäärän säädöllä.

Hihnan avulla voidaan muodostaa kiilamainen väli hihnan ja rainan välille ja siten voidaan applikoida suuri määrä pintaliimaa mikä on edullista etenkin aallotuskartonkia valmistettaessa. Erityisesti kenkäpuristimella saadaan erinomainen tunkeuma rainaan. Kenkäpuristimelle on myös ominaista, että sen avulla voidaan valmistaa laatuja, joilla on korkea bulkki ja/tai paperin tai kartongin lujuus lisääntyy. Rainan lujuuteen oleellisesti vaikuttavien vetysidoksien määrä lisääntyy kun pintaliimaus tehdään märkään paperiin tai kartonkiin. Jo kuivattua rainaa kasteltaessa tapahtuva kuitujen turpoaminen jää pois ja rainan pinnan laatu paranee. Keksinnön mukaisella menetelmällä saadaan aikaan monia laadultaan kilpailukykyisiä paperi- tai kartonkilaatuja tai erinomaista käsiteltyä pohjapaperia korkealuokkaisten päällystettyjen paperilaatujen valmistukseen.

Keksintöä selitetään seuraavassa tarkemmin oheisten piirustusten avulla.

Kuvio 1 esittää kaaviokuvana yhtä keksinnön suoritusmuotoa.

Kuvio 2 esittää kaaviokuvana toista keksinnön suoritusmuotoa.

Kuvio 3 esittää kaaviokuvana kolmatta keksinnön suoritusmuotoa.

5 Kuvio 4 esittää kaaviokuvana neljättä keksinnön suoritusmuotoa.

Kuvio 5 esittää kaaviokuvana viidettä keksinnön suoritusmuotoa.

10 Kuvio 6 esittää kaaviokuvana kuudetta keksinnön suoritusmuotoa.

Kuvio 7 esittää kaaviokuvana keksinnön seitsemättä suoritusmuotoa.

15

Seuraavassa selityksessä käytetään esimerkkinä paperikoneen puristinosan yhteyteen eri tavoin sijoitettua pintaliimausprosessia. Samoja tai oleellisesti samoja suoritusmuotoja voidaan käyttää kartonkikoneissa ja päällysteen tai muun
20 käsittelyaineen levittämiseen rainan pinnalle.

Kuvioiden 1 ja 2 suoritusmuodot sopivat erityisesti paperi- ja kartonkikoneiden uusintoihin sovitettavaksi osaksi koneen kuivatusosaa. Tässä tapauksessa päällystin- tai pinta-
25 liimausasema on sijoitettu juuri ennen kuivaussylinteriryhmää 1, jolloin se on osa koneen puristinosaa. Koska nämä suoritusmuodot on tarkoitettu ensisijaisesti paperikoneiden uusintoihin puristinosan yhteyteen asennettavaksi, laite on osa koneen puristinosaa. Kuvion 1 tapauksessa valmistettava
30 raina tulee huovan tai viiran 2 kuljettamana pintaliimaus- ja puristinasemalle. Rainaa tuova tukielin voi olla koneen rainanmuodostusviira tai jos rainaa on edellä jo kuivattu

puristinnipissä, raina tuodaan puristimen huovalla. Rainan pysyminen tukielimen pinnassa varmistetaan imutelalla 3. Imutelan jälkeen raina siirretään seuraavalle tukielimelle, joka on huopa 4. Rainan siirto tuovalta tukielimeltä 2 ensimmäiselle huovalle 4 tapahtuu imutelan 5 avulla. Imutela 5 painaa ensimmäistä huopaa 4 tukielintä 2 vasten ja telan 5 kehittämä alipaine imee rainan huopaa vasten. Ensimmäinen huopa 4 kuljettaa rainan ensimmäiseen vedenpoistonippiin, jonka muodostavat ensimmäinen huopa 4, toinen huopa 6, toinen imutela 7 ja vastatela 8. Toinen imutela 7 pitää rainan kiinni ensimmäisessä huovassa 4 ja raina kiertää huovan 4 varassa imutelan 7 ympäri. Tähän asemaan on sijoitettu sprayapplikointilaitte S1A, jolla rainan ulospäin osoittavalle pinnalle voidaan suihkuttaa pintaliimaa. Seuraavaksi raina viedään siirtohihnan 9 ja ensimmäisen huovan 4 muodostamaan nippiin, joka on muodostettu likimain siihen kohtaan, jossa ensimmäinen huopa irtaantuu toiselta imutelalta 7. Siirtohihna 9 on sileäpintainen hihna, joka voi olla valmistettu metallista, edullisesti teräksestä tai lujitetusta tai lujittamattomasta kumi- tai polymeerimateriaalista. Metallihihnan voi olla pinnoitettu sopivalla aineella, esimerkiksi keraamipinnoitteella. Polymeerihihnatkin voidaan pinnoittaa mineraalipinnoitteella ja niissä on tavallisesti tukirakenteena kudokset. Siirtohihna 9 kulkee ohjaintelojen tukemana ja hihnan liikesuunnassa ennen ensimmäisen huovan 4 ja siirtohihnan 9 välistä nippiä sijoitetun vastatelan 10 kautta. Vastatelan 10 kohdalle on sijoitettu applikointilaitte S1B pintaliiman levittämiseksi hihnan 9 pinnalle. Applikointilaitte on edullisesti samankaltainen laite mitä käytetään filminsiirtopäällystymien applikointilaitteena ja siinä pintaliiman määrä säädetään ja liima tasoitetaan hihnan pinnalle sauvalla tai terällä.

- Kuten kuviosta 1 nähdään, applikointilaitteita S1A ja S1B voidaan käyttää vaihtoehtoisesti tai yhtäaikaisesti mikäli tarvitaan suuri määrä pintaliimaa samalle puolen rainaa.
- 5 Seuraavaksi siirtohihna 9 ja sen varassa kulkeva raina menevät kääntövastatelan 11 ja puristintelan 12 väliseen nippiin, jossa radasta poistuu vettä ensimmäisen huovan 4 suuntaan. Siirtohihna 9 ja sillä oleva raina kiertävät kääntövastatelan 11. Kääntövastatelaa 11 vasten on sovitettu tässä tapauksessa kenkäpuristin 13, jonka kautta kiertää hihna tai huopa 14. Tässä suoritusmuodossa puristintelan 12 ja vastatelan 11 ja kenkäpuristimen 13 ja vastatelan väliselle alueelle on sovitettu sprayapplikointilaitte S2 pintaliiman syöttämiseksi rainan käsittelemättömälle puolelle.
- 15 Tässä tapauksessa ensimmäiseksi päällystetty puoli joutuu kenkäpuristimen 13 puolella olevaa hihnaa 14 vasten. Jos kenkäpuristimen nipissä käytetään molemmilla puolilla siirtohihnaa, siinä ei poistuu vettä, vaan laite toimii pikemminkin kalanterina joka tasoittaa rainan pintaa. Joissakin tapauksissa voi olla mahdollista käyttää pintaliimauksen yhteydessä myös huopaa, jos sen puhdistuksesta huolehditaan. Päällystyspigmenttejä käytettäessä huovan tukkeentumisvaara on suurempi.
- 25 Kenkäpuristimelta 13 raina jatkaa siirtohihnan 9 pinnalla pois kenkäpuristimen nipistä. Raina poimitaan siirtohihnalta 9 kuivatussyylinteriryhmän kuivatusviiralle 15 kolmannen imutelan 16 avulla. Rainan pysyminen huovalla varmistetaan imulaatikolla 17 ja rainan loppukuivatus tehdään kuivatussyylinteriryhmän 1 avulla, minkä jälkeen raina rullataan koverulliksi tai sitä jatkokäsittelään edelleen paperi- tai kartonkikoneeseen liitetyillä jatkokäsittelylaitteilla. Kun
- 30

raina on erotettu siirtohihnalta 9, hihna puhdistetaan tarvittaessa vesisuihkujen 18 ja kaapimen 19 avulla.

Kun kuvion tapauksessa puristinnippi on viiraosan yhteydessä, huovan 4 tilalla käytetään siirtohihnaa, telassa 5 ei käytetä imua ja sillä on edullista olla vastatela. Päälyste annostellaan ennen telan 5 ja sen vastatelan muodostamaa nippiä sprayapplikointilaitteella. Hitailta koneilla raina voidaan viedä telojen 7 ja 8 muodostaman puristinnipin jälkeen suoraan sylinterikuivatusosalle. Tässä tapauksessa tela 7 on edullisesti kenkätela ja tela 8 voi olla imutela.

Kuvion 2 ratkaisu vastaa kuvion 1 suoritusmuotoa muilta osin, mutta siitä on poistettu ensimmäinen vedenpoistonippi ja huopa ja siihen on lisätty tasauspuristin. Tässä suoritusmuodossa sprayapplikointilaitteet S1A ja S2A ovat vaihtoehtoisia tai täydentäviä laitteita ja pintaliiman levitys tehdään siirtohihnan 9 yhteyteen sovitettun applikointilaitteen avulla rainan ensimmäiselle puolelle. Tällöin kenkäpuristimessa 13 voidaan käyttää huopaa ja poistaa tehokkaasti vettä radasta sen käsittelemättömälle puolelle, jolloin saadaan aikaan edellä mainittu tehokas vedenpoisto ja liiman tunkeutuminen rainaan. Tasauspuristin SN on sijoitettu rainan kulkusuunnassa kenkäpuristimen jälkeen ja se koostuu kahdesta nipin muodostavasta telasta 20, 21, joiden välistä raina ja siirtohihna 9 on sovitettu kulkemaan. Ensimmäinen teloista 20 on siirtohihnan muodostaman lenkin sisäpuolella ja toinen 21 sen ulkopuolella, Siirtohihnalenkin ulkopuolella olevan telan 21 yhteyteen on sovitettu applikointilaitte S2B ja tämä tela 21 toimii applikointilaitteen S2B kanssa filminsiirtopääällystimen tavoin. Pintaliiman appli-

koinnin lisäksi tämän tasauspuristimen avulla voidaan parantaa tunnetulla tavalla sileyttä. Tasauspuristimen sijasta tässä ja muissa keksinnön suoritusmuodoissa voidaan käyttää varsinaista kalanteria, jolloin tarvitaan tavallisesti kaksi telaparia, jos kalanteriteloina käytetään esimerkiksi kuumennettavaa kovaa telaa ja pehmeätä pinnoitettua telaa.

Kuviossa 3 on esitetty laite, jossa on kaksi kenkäpuristinta. Samassa suoritusmuodossa voidaan kenkäpuristimien sijasta käyttää telapuristimia. Raina tuodaan tässäkin tapauksessa edellisestä valmistuslaitteelta viiralla 2 ja siirretään ensimmäisellä imutelalla 5 ensimmäiselle huovalle 4. Ensimmäinen huopa 4 kiertää ensimmäisen kenkäpuristimen 22 kautta. Kenkäpuristin 22 on sijoitettu ensimmäisen huovan 4 lenkin sisäpuolelle ja sitä vastapäätä on vastatela 26, jonka ympäri kiertää toinen huopa 27. Tämän kenkäpuristimen tarkoituksena on ainoastaan poistaa vettä radasta, joten rainan molemmilla puolilla on edullista käyttää huopaa. Ensimmäisen kenkäpuristimen 22 nipistä raina siirretään toiselle huovalle 27 ja rainan kulkusuunnassa on kenkäpuristimen 22 jälkeen spraypäällystysyksikkö S1 pintaliiman levittämiseksi rainan toisesta huovasta 27 pois päin osoittavalle pinnalle. Toiselta huovalta 27 raina siirretään kolmannelle huovalle 31 imutelan 28 avulla ja rainan kulkusuunnassa on seuraavaksi sprayapplikointilaitte S2A, jolla voidaan levittää päällystettä rainan pinnalle. Rainan kulkusuunnassa seuraavana on toinen kenkäpuristin 29, jonka nipin kautta kulkevat kolmas huopa 31 ja siirtohihna 32. Siirtohihna kiertää kenkäpuristimen 29 vastatelan 30 ja applikointivastatelan 33 ympäri. Siirtohihna lenkin ulkopuolelle on applikointivastatelan 33 kohdalla applikointilaitte S2B. Jälleen

applikointilaitteet S2A ja S2B ovat vaihtoehtoisia tai toisiaan täydentäviä.

Kuviossa 4 oleva suoritusmuoto vastaa muuten kuvion 3 suoritusmuotoa, mutta siihen on lisätty tasauspuristin SN, jolla tehdään pintaliimaus ensimmäisen puristinnipin sijaan. Tässäkin tapauksessa tasauspuristimen SN ulkopuoliselle telalle 21 on sovitettu applikointilaitte S2 ja lisäksi kuviossa on esitetty ulkopuolisen eli applikointitelan puhdistuslaitteet 34. Hihnalla 32 voi olla myös puhdistuslaitteet, mutta niitä ei ole tässä kuvattu. Kuviossa 4 on myös kuvattu imulaatikot 36 niissä kohdissa, joissa raina siirretään seuraavalle huovalle imulaatikoiden avulla. Imulaatikoilla varmistetaan rainan pysyminen kiinni huovassa.

15 Rainan kulkusuunnassa ennen toista kenkäpuristinta on päällepuhalluslaatikko, kuivain tai mittalaitte, joka on esitetty kaaviona 37. Ensimmäinen applikointilaitte on sovitettu siirtohihnan 32 yhteyteen ja rainan toisen puolen käsittely tehdään tasauspuristimen SN toisella telalla 21 ja sille

20 sovitetulla applikointilaitteella S2.

Kuvio 5 suoritusmuodossa tasauspuristimeen SN on yhdistetty käsittelyaineen applikointi hihnan 36 avulla. Applikointi-hihna 36 kiertää jatkuvana lenkkinä tasauspuristimen SN telan ja applikointilaitte S2 on sovitettu levittämään pintaliimaa hihnalle. Pintaliima siirtyy rainan pintaan tasauspuristimen nipissä, jonka kautta applikointi-hihna ja siirtohihna 32 kulkevat. Koska nipissä rainan toisella puolella on applikointi-hihna ja toisella siirtohihna, hihnamateriaalin ja erityisesti hihnoiden kovuuksien valinnalla voidaan

30 vaikuttaa tasauspuristimen toimintaan. Kuvion 6 tapauksessa kalanterointiajatus on viety vielä pidemmälle käyttämällä

tasauspuristimena SN kenkäpuristinta. Kenkäpuristimen avul-
la saadaan myös erinomaiset pintapaineen profiloituminais-
suudet myös rainan konesuunnassa ja voidaan parantaa usein
valmistettavan materiaalin paksuutta tietyssä pinnan siley-
5 dessä.

Kuviossa 7 on esitetty suoritusmuoto, jossa pintaliimaus
tehdään rainan muodostamiseen käytettävällä viiraosalla,
jossa tapahtuu ensimmäisen vaiheen vedenpoisto. Rainan kui-
10 va-ainepitoisuus on tällöin erittäin pieni. Raina tulee kä-
sittelylaitteelle paperi- tai kartonkikoneen kuivatusviiran
2 kuljettamana. Kuivatusviiralla 2 rainasta poistuu vettä
ja sen kuiva-ainepitoisuus nousee. Kuivatusviiran kuljetta-
ma raina kulkee kenkäpuristimelle, jonka muodostavat kenkä-
15 tela 40 ja vastatela 41. Kuivatusviira 2 kiertää vastatelan
41 ja kenkätelan 40 ympäri kulkee siirtohihna 39. Siten
raina on kenkäpuristimessa 40, 41 kuivatusviiran 2 ja siir-
tohihnan 39 välissä ja siitä poistuu puristettaessa vettä
viiran 2 suuntaan. Kuivatusviiran 2 ja siirtohihnan 39 vä-
20 lisen kidan edessä on sprayapplikointilaitte, jolla voidaan
levittää käsittelyainetta rainan pinnalle. Koska rainan lu-
juus ennen sen viemistä kenkäpuristimelle on pieni sen si-
sältämästä suuresta vesimäärästä johtuen, sprayapplikointi
on erityisen edullinen applikointitapa tässä suoritusmuo-
25 dossa.

Seuraavaksi raina viedään toiselle puristimelle, joka on
edullisesti kenkäpuristin tämän esimerkin mukaisesti. En-
simmäisen kenkäpuristimen 40, 41 siirtohihna 39 kulkee toi-
30 sen kenkäpuristimen kenkätelan 42 ympäri ja kuljettaa rai-
nan puristimen nippiin. Kenkätelaa 42 vasten on sovitettu
vastatela 43 ja vastatelan 43 ympäri kiertää huopa 44. Täs-

säkin nipissä rainasta poistuu vettä ja veden liikesuunta on huopaa 44 kohti. Seuraavaksi raina viedään siirtohihna 39 varassa viiralle tai huovalle 46. Raina kiinnitetään huopaan 46 siirtohihnan 39 ja huovan 46 kosketuskohtaan si-
5 joitetun imutelan 45 avulla. valmistettavasta paperi- tai kartonkilajista riippuen raina viedään seuraavaksi kuiva- tussylinteriryhmälle, edellä kuvatun kaltaiselle sovittel- malle sen toisen puolen käsittelemiseksi tai jollekin muul- le käsittelylaitteelle.

10

Edellä esitettyjen lisäksi tällä keksinnöllä on muitakin suoritusmuotoja.

Yllä kuvattuja ratkaisuja voidaan muunnella monin tavoin.
15 erityisesti esitettyjen sprayapplikointilaitteiden määrää ja sijaintia on helppo vaihdella tarpeen mukaan. Sprayap- plikoinnin sijasta voidaan usein käyttää ns. jetapplikoin- tia, missä applikoitavan alueen levyisestä suuttimesta pur- sotetaan vapaasti lentävä käsittelyainesuihku. Jetappli-
20 koinnissa päällyste virtaa tasaisena virtana eikä hajoa pi- saroiksi, jolloin spraysumulta vältytään. Suihku voidaan kohdistaa hihnalle, telapinnalle, rainalle tai suoraan nip- piin. Kuitenkin on oleellista, että radalle applikoidaan ainakin yhdessä siirtohihnan tukemassa nipissä päällystettä
25 vettä läpäisemättömän hihnan puolelle. Tässä nipissä on ol- tava edullisesti päällystetyllä puolella vettä läpäisemätön hihna ja toisella puolella vettä läpäisevä huopa. Puristus nipissä voidaan saada aikaan joko telojen tai edullisimmin kenkäpuristimen avulla. Tällaisessa nipissä saadaan aikaan
30 tehokas vedenpoisto rainasta ja samanaikainen rainan pinnan päällystys tai kalanterointi.

Käsittelyaine kuten päällyste tai pintaliima voidaan levittää siirtohihnan pintaan myös esimerkiksi filminsiirtotekniikassa käytettävien applikointilaitteiden avulla. Esimerkeissä kuvattuja sovitelmia voidaan muunnella myös siten, 5 että sovitetaan kahden tai useamman siirtohihnan avulla toimivia pintakäsittely- ja vedenpoistoasemia peräkkäin siten, että hihna voi olla vuorottain rainan eri puolilla. Keksintöä voidaan soveltaa myös monikerrospäällystykseseen, jossa yksi tai useampia päällyste- tai käsittelyainekerroksia 10 tehdään keksinnön mukaisella tavalla.

Vaikka keksinnön mukainen ratkaisu toteutetaankin edullisimmin ilman avoimia vientejä siten, että rainaa tukee aina ainakin yksi jatkuva lenkkimäinen tukielin, tela tai sylinteri, 15 raina voidaan poikkeustapauksissa siirtää avoimen viennin kautta tai ilmatuettuna seuraavalle tukielimelle. Rainaa voidaan kuivata haluttaessa päällepuhalluslaitteella, infrapunakuivaimella tai vastaavalla käsittelyn jälkeen sen ollessa hihnan tai huovan tukemana ennen sen joutumista 20 seuraavaan nippiin ennen rainan tuetun puolen vaihtumista käsitellylle puolelle tai rainan siirtoa sylinterikuiva-tusosalle. Käsittelyaineen koostumus ja olomuoto eivät sinänsä vaikuta keksinnön toimintaan, mutta voivat vaatia tiettyntyyppiset applikointilaitteet tai muutoksia laitteiston fyysiseen rakenteeseen. 25 Käsittelyaine voi olla neste, liuos, dispersio, emulsio tai vaahto tai muu riittävän helposti annosteltava ja levitettävä aine.

Keksinnön mukaisiin menetelmiin voidaan yhdistää päällystämäärän mittausta rainan ollessa tuettuna hihnaa tai viiraa vasten. Tällöin ei voida käyttää rainan molemmin puolin sijoitettavia mittalaitteita. Soveltuva mittaustapa esimer-

kiksi pohjapaperin täyteainemäärän ja päällystemäärän mit-
taamiseen on röntgenfluorenssimenetelmä CaCO_3 pigmenteille.
Röntgenfluorenssimittaukseen voidaan yhdistää kokonaispai-
non ja kosteuden mittaus jollain tavanomaisella tavalla,
5 jolloin saatujen tietojen avulla voidaan laskea useita laa-
tutekijöitä.

Patenttivaatimukset:

1. Menetelmä liikkuvan rainan käsittelemiseksi paperi- tai kartonkikoneessa, jossa

5

- muodostetaan raina, liikkuvalle viiralle,

- poistetaan rainasta vettä puristamalla,

10

- kuivataan rainaa ainakin yhdellä kuivainsylinterillä, ja

- pintakäsitellään rainaa ainakin yhdellä menetelmällä ennen ensimmäistä kuivainsylinteriä,

15

t u n n e t t u siitä

- asetetaan raina kulkemaan siirtohihnan tukemana ainakin yhden ennen ensimmäistä kuivainsylinteriä tehtävän pintakäsittelyvaiheen aikana.

20

2. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t t u siitä, että applikoidaan rainan pintaan ennen ensimmäistä sylinterikuivainta ainakin yhdessä vaiheessa käsittelyainetta ja asetetaan raina kulkemaan siirtohihnan (9) tukemana siten, että rainan se puoli, jolle levitetään käsittelyainetta on siirtohihnaa (9) vasten, jolloin käsitte-
lyaine puristuu siirtohihnan avulla rainaan.

25

30 3. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t t u siitä, että kalanteroidaan ainakin rainan toinen puoli siirtohihnaa vasten.

4. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t -
t u siitä, että pintakäsitellään rainaa sen kuiva-
ainepitoisuuden ollessa 10 - 60%.

5

5. Patenttivaatimuksen 1, 2 tai 3 mukainen menetelmä,
t u n n e t t u siitä, että poistetaan radasta vettä aina-
kin yhdessä vaiheessa puristamalla rainaa jatkuvan huovan
(14) välityksellä siirtohihnaa (9) vasten paininelimellä
10 (13).

6. Patenttivaatimuksen 5 mukainen menetelmä, t u n n e t -
t u siitä, että puristetaan rainaa huovan (14) välityksel-
lä painamalla sitä siirtohihnaa (9) vasten kenkäpuristimel-
15 la (13).

7. Patenttivaatimuksen 5 mukainen menetelmä, t u n n e t -
t u siitä, että puristetaan rainaa huovan (14) välityksel-
lä painamalla sitä siirtohihnaa (9) vasten telalla (12).

20

8. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t -
t u siitä, että kuivataan rainaa kosketuksettomalla kui-
vaimella ennen ensimmäistä kuivainsylinteriä.

25 9. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t -
t u siitä, että kuljetetaan rainaa ainakin silloin, kun
siitä poistetaan vettä puristamalla siten, että se on jat-
kuvasti kosketuksessa ainakin yhden jatkuvan lenkkimäisen
tukielimen kuten viiran, huovan tai siirtohihnan kanssa.

30

10. Patenttivaatimuksen 1 tai 2 mukainen menetelmä, t u n -
n e t t u siitä, että levitetään käsittelyainetta siirto-

hihnan (9) pinnalle filminsiirtopääällystimen applikointilaitteella, sprayapplikointilaitteella, jetapplikointilaitteella tai lyhytviipymäapplikointilaitteella ja viedään käsittelyaine siirtohihnan (9) pinnalla filminä radalle.

5

11. Patenttivaatimuksen 1 tai 9 mukainen menetelmä, t u n n e t t u siitä, että levitetään käsittelyainetta ainakin yhdessä vaiheessa suoraan rainan pinnalle sprayapplikointilaitteella (S1A, S2).

10

12. Patenttivaatimuksen 1 tai 9 mukainen menetelmä, t u n n e t t u siitä, että levittää käsittelyainetta suoraan siirtohihnan ja rainan väliseen nippiin.

15

13. Patenttivaatimuksen 1 tai 12 mukainen menetelmä, t u n n e t t u siitä, että levitetään käsittelyainetta siirtohihnalle ja tarvittaessa myös suoraan radalle sellainen määrä, että rainan ja siirtohihnan väliseen kosketuskulmaan muodostuu lammikko.

20

14. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t t u siitä, että käsitellään rainaa tasauspuristimella ennen sen viemistä ensimmäiselle kuivainsylinterille.

25

15. Patenttivaatimuksen 14 mukainen menetelmä, t u n n e t t u siitä, että siirtohihna (32) on sovitettu kulkemaan tasauspuristimen (SN) nipin läpi.

30

16. Patenttivaatimuksen 14 tai 15 mukainen menetelmä, t u n n e t t u siitä, että käsitellään rainaa kaksi nipin muodostavaa telaa (20, 21) käsittävällä tasauspuristimella ja levitetään tasauspuristimen toiselle telalle (21) käsit-

telyainetta applikointilaitteella (S2) ja siirretään käsittelyaine telan (21) pinnalla radalle.

17. Patenttivaatimuksen 15 mukainen menetelmä,
5 t u n n e t t u siitä, että käsitellään rainaa kaksi nipin muodostavaa telaa (20, 21) ja toisen telan (21) ympäri kiertävän hihnan (36) käsittävällä tasauspuristimella (SN) ja levitetään tasauspuristimen hihnalle käsittelyainetta applikointilaitteella (S2) ja siirretään käsittelyaine hih-
10 nan (36) pinnalla radalle.

18. Patenttivaatimuksen 15 mukainen menetelmä,
t u n n e t t u siitä, että käsitellään rainaa telan (21), kenkäpuristimen (37) ja telan (21) ympäri kiertävän hihnan
15 (36) käsittävällä tasauspuristimella (SN) ja levitetään tasauspuristimen hihnalle (36) käsittelyainetta applikointilaitteella (S2) ja siirretään käsittelyaine hihnan (36) pinnalla radalle.

20 19. Patenttivaatimuksen 2 mukainen menetelmä, t u n n e t t u siitä, että asetetaan raina kulkemaan kahden toisiaan vasten puristettavan siirtohihnan (32, 36) välistä ja levitetään käsittelyainetta molempien hihnojen (32, 36) pinnoille ja siirretään aine samanaikaisesti rainan molemmille
25 pinnoille.

20. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t t u siitä, että tuetaan rainaa ainakin osittain puristamalla tehtävän vedenpoiston aikana huovalla, hihnalla, te-
30 lalla, sylinterillä tai ilmatuentalaitteella.

21. Jonkin patenttivaatimuksista 1, 8 - 20 mukainen mene-

telmä, t u n n e t t u siitä, että kuivataan rainaa ensimmäisessä päällystysvaiheessa käsittelyaineen levittämisen jälkeen kosketuksettomalla kuivaimella, esimerkiksi säteilylämpökuivaimella tai ilma-kuivaimella.

5

22. Jonkin patenttivaatimuksista 1, 10 - 21 mukainen menetelmä, t u n n e t t u siitä, että levitetään ainakin rainan toiselle puolelle ainakin kaksi käsittelyainekerrosta ainakin kahdessa eri vaiheessa.

10

23. Jonkin patenttivaatimuksista 1, 10, 22, mukainen menetelmä, t u n n e t t u siitä, että levitetään ainakin yksi kerros päällystettä radalle filminsiirtotelan (21) avulla.

15

24. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t t u siitä, että käytetään käsittelyainetta, joka on pintaliimaa tai päällysteseosta nestemäisessä, dispersio-, emulsio-, tai vaahtomuodossa.

20

25. Patenttivaatimuksen 1 mukainen menetelmä, t u n n e t t u siitä, että puristetaan rainaa siirtohihnan (9) välityksellä telaa vasten.

25

26. Sovitelma paperin tai kartongin valmistuskoneessa, joka käsittää

- viiraosan (2, 3) liikkuvan paperi- tai kartonkirainan muodostamiseksi,

30

- kuivatuselimet (4 - 14) rainan puristamiseksi veden poistamiseksi rainasta,

- ainakin yhden kuivatussyylinterin (1) rainan kuivaimiseksi,

- 5 - ainakin yhden pintakäsittelylaitteen (S1A, S1B tai SN) rainan pinnan käsittelemiseksi ennen ensimmäistä kuivatussyylinteriä (1),

t u n n e t t u

10

- ainakin yhdestä jatkuvan lenkin muodostavasta siirtohihnasta (9), jota vasten liikkuva raina on sovitettu kulkemaan pintakäsittelyn aikana.

- 15 27. Patenttivaatimuksen 26 mukainen sovitelma, t u n n e t t u elimistä (S1A, S1B) käsittelyaineen applikoimiseksi rainan siirtohihnaa (9) vasten osoittavalle puolellesiten, että applikoitu aine puristuu hihnan (9) välityksellä rainaan.

20

28. Patenttivaatimuksen 26 tai 27 mukainen sovitelma, t u n n e t t u siitä, että ainakin yksi pintakäsittelylaite on kalanteri.

- 25 29. Patenttivaatimuksen 26 mukainen sovitelma, t u n n e t t u

30 - huovasta (14), joka on sovitettu kulkemaan siirtohihnaa (9) vasten siten, että käsiteltävä raina kulkee huovan (14) ja siirtohihnan(9) välistä, ja

- ainakin yhdestä paininelimestä (13) huovan (14) pu-

ristamiseksi siirtohihnaa (9) kohti veden puristamiseksi radasta.

30. Patenttivaatimuksen 29 mukainen sovitelma, t u n -
5 n e t t u siitä, että paininelin on kenkäpuristin (13).

31. Patenttivaatimuksen 29 mukainen sovitelma, t u n -
n e t t u siitä, että paininelin on tela (12).

10 32. Patenttivaatimuksen 27 mukainen sovitelma, t u n -
n e t t u ainakin yhdestä kosketuksettomasta kuivaimesta
rainan kuivaamiseksi ennen ensimmäistä kuivainsylinteriä.

15 33. Patenttivaatimuksen 26 mukainen sovitelma, t u n -
n e t t u ainakin yhdestä huovasta (4), viirasta tai hih-
nasta (9) ja elimistä (5) rainan poimimiseksi rainanmuodos-
tusviiralta (2) ja viemiseksi ainakin yhden huovan (4),
viiran tai hihnan tukemana seuraavalle hihnalle (9) huoval-
le tai viiralle.

20 34. Patenttivaatimuksen 33 mukainen sovitelma, t u n -
n e t t u kuivatussylinterien muodostaman ryhmän (1) vii-
rasta (15) ja elimistä (16) rainan poimimiseksi siirtohih-
nalta ja kuljettamiseksi ainakin osittain viiran tukemana
25 kuivatussylinterien (1) kautta.

35. Patenttivaatimuksen 34 mukainen sovitelma, t u n -
n e t t u ainakin yhdestä huovasta (4) ja ainakin yhdestä
siirtohihnasta (9) rainan kuljettamiseksi jatkuvasti tuet-
30 tuna ja kosketuksessa jatkuvaan lenkkimäisen tukielimeen
puristavan vedenpoistovaiheen läpi.

36. Patenttivaatimuksen 26 mukainen sovitelma, t u n -
n e t t u elimistä käsittelyaineen levittämiseksi siirto-
hihnan pinnalle, jotka elimet voivat olla filminsiirtopääl-
lystimen applikointilaite, sprayapplikointilaite, jetappli-
5 kointilaite tai lyhytviipymäapplikointilaite.

37. Patenttivaatimuksen 26 mukainen sovitelma, t u n -
n e t t u ainakin yhdestä puristavien kuivatuselinten alu-
eelle sovitetusta sprayapplikointilaitteesta (S1A) käsitte-
10 lyaineen levittämiseksi suoraan radalle tai rainan ja siir-
tohihnan väliseen nippiin.

38. Patenttivaatimuksen 26 mukainen sovitelma, t u n -
n e t t u ennen kuivatussylintereitä (1) sijaitsevasta ta-
15 sauspuristimesta (SN) tai kalanterista, jonka kautta raina
on sovitettu kulkemaan.

39. Patenttivaatimuksen 38 mukainen sovitelma, t u n -
n e t t u siitä, että siirtohihna (9) on sovitettu kulke-
20 maan tasauspuristimen kautta.

40. Patenttivaatimuksen 39 mukainen sovitelma, t u n -
n e t t u elimistä (S2B) käsittelyaineen levittämiseksi
tasauspuristimen (SN) siirtohihnaalenkin (9) ulkopuolella
25 olevalle telalle (21).

41. Patenttivaatimuksen 38 tai 39 mukainen sovitelma,
t u n n e t t u siirtohihnaalenkin (9) ulkopuolella olevan
telan (21) ympäri kiertäväksi sovitetusta hihnasta (36) ja
30 elimistä (S2) käsittelyaineen levittämiseksi hihnan (36)
pinnalle.

42. Patenttivaatimuksen 41 mukainen sovitelma, t u n -
n e t t u siitä, että tasauspuristin (SN) käsittää kenkä-
puristimen (37).

5 43. Patenttivaatimuksen 26 mukainen sovitelma, t u n -
n e t t u

10 - ainakin kahdesta siirtohihnasta (32, 36), jotka on
sovitettu kulkemaan ainakin osittain vastakkain siten,
että raina kulkee niiden välistä,

- elimistä (S1, S2) käsittelyaineen levittämiseksi
hihnojen (32, 36) pinnoille, ja

15 - elimistä (20, 21) hihnojen (32, 36) puristamiseksi
yhteen applikointipaineen muodostamiseksi.

20 44. Jonkin patenttivaatimuksista 26, 36, 37, 40, 43 mukai-
nen sovitelma, t u n n e t t u ainakin yhdestä kosketuk-
settomasta kuivaimesta, esimerkiksi säteilykuivaimesta tai
ilmakuivaimesta, rainan kuivaamiseksi käsittelyaineen le-
vittämisen jälkeen.

25 45. Patenttivaatimuksen 26 mukainen sovitelma, t u n -
n e t t u ainakin yhdestä filminsiirtotelasta (21) käsit-
telyaineen levittämiseksi rainan pinnalle.

30 46. Patenttivaatimuksen 26 mukainen sovitelma, t u n -
n e t t u siitä, että ainakin yksi siirtohihna on sovitet-
tu kulkemaan telan kautta siten, että rainaa voidaan puris-
taa siirtohihnalla telaa vasten.

(57) Tiivistelmä

Menetelmä, jonka avulla paperi- tai kartonkirainaa voidaan käsitellä kostuttavalla aineella tai kalanteroida ennen paperi- tai kartonkikoneen sylinterikuivatusosaa rainan kuiva-ainepitoisuuden ollessa hyvin alhainen, tyypillisesti 10 - 60% ja jonka avulla raina voidaan kuljettaa haluttaessa täysin tuettuna paperi- tai kartonkikoneen viiraosalta haluttaessa aina kiinnirullaimelle saakka ja samalla hyödyntää rainan kosteuspitoisuuden ja kosteuden hallitun siirtymisen mahdollistamia laatuetauja. Raina kuljetetaan siirtohihnan (9) tukemana ainakin yhden pintakäsittelylaitteen, kuten pääällystysaseman (S1B) tai kalanterin kautta ennen sen viemistä paperi- tai kartonkikoneen ensimmäiselle kuivainsylinteriryhmälle (1). Yhdessä siirtohihnan (9) tuke-
massa nipissä (11, 13) voidaan poistaa vettä samanaikaisesti kuin käsittelyainetta siirretään rainaan. Vettä poistava nippi (11, 13) voi muodostua siirtohihnasta (9) ja viiraosan viirasta (2) tai puristinosan huovasta (14).

Kuvio 1

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Patent- och registreringsverket
Box 5055
S-102 42 Stockholm
Sverige

19 April 2001

VIITTEENNE:
YOUR REFERENCE:

VIITTEEMME:
OUR REFERENCE:

PCT/FI00/00190

VAL 201 PCT

TELEFAX AND MAIL
(9 PAGES)

Re.: International Patent Application No. PCT/FI00/00190
in the name of VALMET CORPORATION

Referring to the written opinion of 5 March 2001 we hereby
present following amendments and remarks:

We enclose new pages 9, 17 and 21 - 25 that replace the earlier
corresponding pages. New independent claims 1 and 26 replace the
previous corresponding claims.

In the independent claims it has been included a feature that the
transfer belt is impervious to water. The amendment is based on
the text on pages 8, (lines 23 -29), 10 (lines 20 - 24), 14
(lines 35 - 37) and 15 (lines 1 - 4). Lines 25 to 29 has been
removed from page 9 since on bases of these lines it would have
been possible to draw an erroneous conclusion that treating agent
is spread only on a permeable porous material. Spreading a
treating agent on a permeable material in production environment
is also practically impossible because of adherence of the
treating agent on the material used.

No new material has been added.

The invention is based in that, that a treating agent, for
example size or a coating colour, is spread on a surface of a web
by a transfer belt that is impervious to water. The advantage
therein is naturally that the surface of the web will be smoother
and the smooth belt does not get dirty as badly as a porous felt
or a wire. The most important feature of the invention is
although that when a to water impervious surface acts as a

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transfer surface, water can not move towards the treated surface but is pressed in the web. If the web is backed by a felt or a wire, water is removed therethrough. Since the treatment is done when the web is essentially wet, the water penetrating the web is not harmful and a large amount of the water is removed before the dryer cylinders by pressing. Therefore coating or sizing can be done according to the invention on the press section of a paper machine without affecting essentially the drying process.

In EP 881 349 fibres or particles are added on a surface of a web by film transfer method. In order to perform the method in a desired way the film transfer roll can not be pressed forcefully against the web and no essential transfer of water occurs in a short application nip anyway. Thereby this method does not provide a measure for controlling the transfer of water and it is merely an application method.

In US 5,575,891 the treating agent is spread on a porous material even though the publication cites a belt, which addresses usually an impermeable material. It is clear that this belt has to be permeable in order to allow the suction boxes, vacuum pickup shoes and blow boxes to operate as described in the publication. These features are described in the publication and cited also in the written opinion.

It is clear that the transfer of water towards the treated side of the web can not be prevented by the teachings of the cited references, but the water is transferred also on the treated surface, which deteriorates its quality.

Since a characterizing feature of our invention described in the amended independent claims is not described, the invention is new. The invention further includes a feature that provides a teaching that can not be deducted on the basis of the cited references since it is based on a phenomena that is not present in the apparatuses and methods described. Therefore the invention involves inventive step according to our opinion.

On the basis of the included amendments and above presented reasons it is respectfully solicited that the invention defined in the present amended claims be considered novel and inventive whereby we hope that a positive preliminary examination report can be issued.

Seppo Laine Oy

Simo Hovi

Encls. new pages 9, 17, 21-25 in triplicate

is metered and the size is smoothed on the belt surface by means of a rod or blade.

As is shown in FIG. 1, the applicator devices S1A and S1B
5 can be used alternatively or even simultaneously when a large amount of surface size has to be applied to the same surface of the web. Next, the transfer belt 9 with the web travelling thereon is passed into a nip between a deflecting backing roll 11 and a press roll 12, wherein
10 water is removed from the web toward the first felt 4. The transfer belt 9 with the web running thereon passes over the deflecting backing roll 11. In the illustrated embodiment, a shoe press 13 adapted to operate against the deflecting backing roll 11 over which a belt or the
15 felt 14 is adapted to pass. In order to apply surface size to the untreated side of the web, this embodiment has a spray applicator S2 adapted at a point along the web passage between the nip of the press roll 12 and its backing roll 11 and the nip between the shoe press 13 and
20 its backing roll. In this arrangement, the first coated side of the web will face the belt 14 that runs over the shoe press 13. If the nip of the shoe press is adapted to have a transfer belt on both sides thereof, no dewatering takes place in the nip, but rather, the press acts as a
25 calender that smooths the web surface.

From the shoe press 13, the web travels on the transfer belt 9 out from the shoe press nip. The web is picked
30 from the transfer belt 9 onto the dryer wire 15 of the dryer cylinder group by a third suction roll 16. Adherence of the web to the felt is secured by means of a suction box 17, and the final drying of the web is carried out by means a dryer cylinder group 1, whereupon the web

What is claimed is:

1. Method for treating a moving web in a paper- or boardmaking machine, wherein

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- forming a web on a moving wire,

- removing water from the web by pressing,

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- drying the web by means of at least one dryer cylinder, and

- subjecting the web to surface treatment by means of at least one technique prior to the first dryer cylinder,

15

c h a r a c t e r i z e d in that

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- arranging the web to travel supported by a transfer belt impervious to water during at least one treatment step prior to said first dryer cylinder.

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2. Method according to claim 1, c h a r a c t e r i z e d in that a web treatment substance is applied to the web surface during at least one treatment step prior to the first dryer cylinder and the web is arranged to travel supported by a transfer belt (9) so that the side of the web to which the treatment substance is applied is facing the transfer belt (9), whereby the treatment substance is pressed by means of the transfer belt onto the web.

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3. Method according to claim 1, c h a r a c t e r i z e d in that at least one side of the web is calendered against a transfer belt.

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4. Method according to claim 1, c h a r a c t e r -

c h a r a c t e r i z e d in that at least two layers of treatment substance are applied at least to one side of the web during at least two separate web treatment steps.

- 5 23. Method according to any one of claims 1, 10, 22, c h a r a c t e r i z e d in that at least one layer of a web treatment substance is applied to the web by means of a film-transfer roll (21).
- 10 24. Method according to claim 1, c h a r a c t e r - i z e d by using a web treatment substance comprising surface size or coating mix in the form of a liquid, dispersion, emulsion or foam.
- 15 25. Method according to claim 1, c h a r a c t e r - i z e d in that the web is pressed against a roll by means of a transfer belt (9).
- 20 26. Assembly for a paper- or boardmaking machine, the assembly comprising
- a wire section (2, 3) for forming a moving web of paper or board,
 - 25 - dryer means (4 - 14) for removing water from the web by pressing,
 - at least one dryer cylinder (1) for drying the web, and
 - 30 - at least one surface treatment device (S1A, S1B or SN) for treating the surface of the web prior to the first dryer cylinder (1),
- 35 c h a r a c t e r i z e d by
- at least one transfer belt (9) that is impervious

to water forming an endless loop against which the web is arranged to travel during a surface treatment step.

5 27. Assembly according to claim 26, c h a r a c t e r -
i z e d by means (S1A, S1B) for applying a treatment
substance to the web surface facing a transfer belt (9)
in a manner that causes the applied substance to be
pressed into the web by means of said belt (9).

10 28. Assembly according to claim 26 or 27, c h a r a c -
t e r i z e d in that at least one of a surface
treatment devices is a calender.

15 29. Assembly according to claim 26, c h a r a c t e r -
i z e d by

- a felt (14) adapted to travel against said
transfer belt (9) so that the web to be treated is
20 passed between the felt (14) and the transfer belt
(9), and

- at least one pressing means (13) for pressing the
felt (14) against the transfer belt (9) for removing
25 water from the web by pressing.

30 30. Assembly according to claim 29, c h a r a c t e r -
i z e d in that said pressing means is a shoe press
(13).

31. Assembly according to claim 29, c h a r a c t e r -
i z e d in that said pressing means is a roll (12).

35 32. Assembly according to claim 27, c h a r a c t e r -
i z e d by at least one noncontacting dryer means used
for drying the web prior to the first dryer cylinder.

33. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one felt (4), wire or belt (9) and
means (5) for picking the web off from a web-forming wire
(2) and passing the same supported by at least one felt
5 (4), wire or belt to the next belt (9), felt or wire.

34. Assembly according to claim 33, c h a r a c t e r -
i z e d by a wire (15) of a group (1) of dryer cylinders
and means (16) for picking the web off from said transfer
10 belt and passing the web at least partially supported by
said wire via said dryer cylinders (1).

35. Assembly according to claim 34, c h a r a c t e r -
i z e d by at least one felt (4) and at least one
15 transfer belt (9) for passing the web in a continuously
supported manner and in continuous connection with said
endless loop support means through a pressing dewatering
step.

20 36. Assembly according to claim 26, c h a r a c t e r -
i z e d by means for applying a web treatment substance
to the surface of the transfer belt, whereby said means
may comprise a film-transfer applicator, spray applica-
tor, jet applicator or short-dwell applicator device.

25 37. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one spray applicator device (S1A)
located within the area of the pressing dryer means for
applying a web treatment substance directly to the web or
30 into the nip defined between the web and the transfer
belt.

38. Assembly according to claim 26, c h a r a c t e r -
i z e d by a calibrating press (SN) located in front of
35 the dryer cylinders (1) or a calender through which the
web is adapted to pass.

39. Assembly according to claim 38, c h a r a c t e r -
i z e d in that the transfer belt (9) is adapted to pass
through the calibrating press.

5 40. Assembly according to claim 39, c h a r a c t e r -
i z e d by means (S2B) for applying a web treatment
substance on a roll (21) located on the exterior side of
the endless-loop transfer belt (9) of the calibrating
press (SN).

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41. Assembly according to claim 38 or 39, c h a r a c -
t e r i z e d by a belt (36) adapted to pass as an
endless loop over said roll (21) located on the exterior
side of the endless-loop transfer belt (9) and by means
15 (S2) for applying a web treatment substance on the
surface of said belt (36).

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42. Assembly according to claim 41, c h a r a c t e r -
i z e d in that said calibrating press (SN) comprises a
shoe press (37).

43. Assembly according to claim 26, c h a r a c t e r -
i z e d by

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- at least two transfer belts (32, 36) adapted to
move at least a portion of their travel opposed to
each other so that the web is passed therebetween,

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- means (S1, S2) for applying a web treatment
substance to the surfaces of the belts (32, 36), and

- means (20, 21) for pressing said belts (32, 36)
against each other for setting up an application
pressure.

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44. Assembly according to any one of claims 26, 36, 37,
40, 43, c h a r a c t e r i z e d by at least one

noncontacting dryer such as a radiant heat dryer or air-impingement dryer serving to dry the web after the application of a web treatment substance.

5 45. Assembly according to claim 26, c h a r a c t e r -
i z e d by at least one film-transfer roll (21) for
applying a web treatment substance to the web surface.

10 46. Assembly according to claim 26, c h a r a c t e r -
i z e d in that at least one transfer belt is adapted to
pass over the roll in a manner permitting the web to be
pressed by means of the transfer belt against the roll.

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(21) International Application Number: PCT/FI00/00190 (22) International Filing Date: 10 March 2000 (10.03.00) (30) Priority Data: 990557 12 March 1999 (12.03.99) FI <i>12 Sep 01/30 mos.</i> (71) Applicant (for all designated States except US): VALMET CORPORATION [FI/FI]; Fabianinkatu 9 A, FIN-00130 Helsinki (FI). (72) Inventors; and (75) Inventors/Applicants (for US only): KORHONEN, Hannu [FI/FI]; Hollituvantie 23, FIN-40200 Jyväskylä (FI). RANTANEN, Rauno [FI/FI]; Oksalanmäki, FIN-40950 Muurame (FI). (74) Agent: SEPPO LAINE OY; Itämerenkatu 3 B, FIN-00180 Helsinki (FI).		(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, DZ, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS; MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>In English translation (filed in Finnish).</i>
(54) Title: METHOD AND APPARATUS FOR HANDLING A PAPER OR BOARD WEB ✓ (57) Abstract <p>A method for treating a web of paper or board with a wetting substance or calendering the web prior to the cylinder dryer section of a paper- or boardmaking machine while the solids content of the web is still very low, typically in the range of 10 - 60 %, wherein the web can be conveyed when so desired fully supported from the wire section of the paper- or board making machine up to the winder, while simultaneously utilizing the quality benefits obtained from a controlled reduction of the web moisture content and dewatering of the same. The web is conveyed supported by a transfer belt (9) through at least one web surface treatment apparatus such as a coater station (S1B) or a calender prior to passing the web to the first dryer cylinder group (1) of the paper- or boardmaking machine. One nip (11, 13) supported by a transfer belt (9) is suitable for dewatering simultaneously with the application of a treatment substance to the web. The dewatering nip (11, 13) may be formed between a transfer belt (9) and the wire (2) of the wire section or the felt (14) of the press section.</p>		

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Method and apparatus for handling a paper or board web

The present invention relates to a method according to
5 the preamble of claim 1 for coating webs of paper and
board or for surface sizing the same in order to improve
their printability, strength or other qualities.

The invention also relates to an assembly suited for
10 implementing said method.

In order to improve the qualities of a paper or board
sheet, the base web of the paper or board sheet is treat-
ed in different ways. The goal of each treatment is to
15 improve the strength or printability properties of the
produced grade. Strength improvement is principally ac-
complished by way of surface sizing, wherein the web sur-
face is coated with a strength-improving sizing agent
such as a starch solution. Coating is applied, among
20 other reasons, for such purposes as better product
brightness, surface impermeability or smoothness, while
calendering serves to improve the surface smoothness and
gloss.

25 Conventionally, web treatment is performed after base web
formation so that a dry web is treated in separate off-
line equipment or, alternatively, in online equipment
connected directly after the paper- or boardmaking
machine. Herein, the web is dried at least essentially
30 close to its final degree of moisture content, whereby
the web must be moistened and redried particularly during
surface sizing and coating, which increases the machine
length and energy consumption. As modern paper/board-
making machines are already equipped with efficient
35 dewatering and drying sections, it would be advantageous
to have the web-wetting operations such as surface sizing
and coating moved as close as possible to the headbox so

as to take place within the wire section or press section, whereby the dewatering and drying of the base sheet having the surface treatment agent applied thereto can be accomplished at least partially simultaneously.

5 Surface sizing and coating performed at the press or wire section would also offer substantial quality benefits inasmuch the penetration of the surface sizing agent into the web takes place in a manner entirely different from that when the treatment agent causing web wetting is

10 applied to an already dried base sheet. The quality of calendering is improved if this step is carried out on a web of higher moisture content, whereby also the outcome of calendering for the most common paper and board grades would benefit from being performed at the press section

15 of a paper/boardmaking machine.

The history of having the base sheet formation and finishing phases chained in two separate steps can be traced to two major factors. Firstly, the formation of

20 the base sheet and its subsequent finishing have traditionally been considered extremely autonomous production phases to be implemented independently from each other. Secondly, paper webs in particular and even board webs are very fragile prior to their drying close to the final

25 solids content, whereby it has not been possible to execute such treatments that cause wetting of the web without jeopardizing web runnability.

From the art is known an embodiment in which surface

30 sizing is carried out using a film-transfer applicator. In a film-transfer application apparatus, a coating film metered very accurately on a rotating film-transfer roll is transferred from the roll to the surface of the running web. Although a film-transfer applicator offers

35 very good runnability and causes a minimal stress on the web, the water permeating the web anyhow weakens its strength. Since the web will not be passed directly from

the film-transfer roll onto a supporting element such as a wire, an unsupported gap remains between the film-transfer roll and the subsequent supporting element. Hence, the web is always subjected to stresses in the cross-machine direction and particularly in the machine direction. For instance, variations in the moisture content profile may cause stress peaks on the web that readily break the wet and fragile web.

10 In addition to the technique of film-transfer application, use of spray application has been proposed in the art, wherein the surface size or coating mix is applied to the web by means of an array of spraying nozzles staggered in the cross-machine and/or the machine
15 direction.

In US Pat. No. 3,146,159 is described an embodiment in which application is performed on a wet web by coating one side of the web and simultaneously supporting the web during application from its other side by a fabric. Coating on a calibrating press is also described.

US Pat. No. 4,793,899 describes spray-coating and short-dwell application techniques, wherein the web support arrangement is more advanced than that of the above-cited patent, however, not even this embodiment being free from unsupported web travel passages and the applicator still having a web-supporting fabric therein.

30 Further referring to US Pat. No. 5,152,872, there is described an embodiment free from unsupported web travel passages. In this arrangement, the coating mix is first metered on the outer surfaces of rolls and therefrom directly to the web, yet having a felt running in the
35 nip.

It is an object of the present invention to provide a

method suited for treating a paper or board web with a wetting substance or, alternatively, calendering the web prior to the cylinder dryer section of a paper- or board-making machine meanwhile the solids content of the web is
5 still very low, typically 10 - 60 %.

It is a further object of the invention to provide a method in which the web can be passed fully supported from the wire section of the paper- or boardmaking
10 machine, when desired, up to the winder, thus utilizing the quality improvement benefits offered by a controlled management of web moisture content and wetting.

The goal of the invention is achieved by way of passing
15 the web supported by a transfer belt through at least one surface treatment section such as a coater station or a calender prior to taking the web to the first dryer cylinder group of the paper- or boardmaking machine.

20 According to one advantageous embodiment of the invention, at least one nip supported by the web-transferring belt is used for dewatering simultaneously with the application of a web treatment agent to the web. The dewatering nip may be formed between a transfer belt
25 and the wire of the wire section or the felt of the press section of the machine. As a matter of convenience, dewatering in a nip between the transfer belt and the wire is defined to comprise a portion of the press section, whereby reference to a nip of the press section
30 in the following text may also be understood to include a nip formed between a wire and a web transfer belt.

More specifically, the method according to the invention is characterized by what is stated in the characterizing
35 part of claim 1.

Furthermore, the assembly according to the invention is

characterized by what is stated in the characterizing part of claim 26.

The invention offers significant benefits.

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One of the most important benefits of the invention is that the invention allows a coated or surface-sized board or paper to be manufactured in a machine of vastly simplified or shorter construction over those known in the prior art, because the web surface treatment and drying steps can be carried out in a single or almost single space and with the same equipment that in the prior art served for dewatering on the press section and the dryer. Accordingly, the machinery is principally comprised of existing sections. If the machinery is equipped with a calender section, it may be located at the most advantageous point along the line in respect to the web moisture content and treatability of the paper grade being manufactured. The efficiency of the web drying process is improved, because drying can be performed only once without the need for rewetting an already dried web. Water removal is also performed more cost-effectively from a very wet web than from a dry web. If the surface sizing or coating application step is carried out, e.g., in the press section nip so that the web is supported from the side to be treated by the transfer belt and from the other side by a felt or wire, water is removed from the web toward the felt or the wire, thus allowing the treatment substance to penetrate into the web. In the best case, the entire volume of water corresponding to that of the treatment substance is subsided from the wet web into the felt, whereby the drying capacity needed for web dewatering is not increased. In this manner, the invention can provide so good a web surface smoothness that soft-calendered qualities of paper or board can be made with an acceptable quality. Water transport and removal as well as the

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calendering effect may be augmented by heating the web transfer belt or its support roll. By means of a heated belt, it is possible to control the temperature profile of the web, whereby the moisture content or smoothness profile of the web, for instance, may be varied. Additionally, the adjustment of the size metering can be used for controlling the moisture content profile.

The support belt helps to form a tapering nip between the belt and the web, thus allowing a large amount of surface size to be applied which is advantageous particularly in the manufacture of boxboard. Particularly a shoe press is capable of providing an excellent penetration in the web. Typically a shoe press is also suitable of being used in the manufacture of grades having a high bulk and/or improved strength of the paper or board web. By way of applying the surface size on a wet paper or board, the number of hydrogen bonds that principally determine the web strength is increased. Also the swelling of fibers that occurs during the wetting of a dry web is eliminated, whereby the web surface quality is improved. The method according to the invention is suitable for making a great number of paper or board grades with a competitive-edge quality or for producing a base paper of excellent finish for conversion into high-quality coated grades.

In the following, the invention will be examined in greater detail by making reference to the appended drawings in which

FIG. 1 shows schematically a first embodiment of the invention;

FIG. 2 shows schematically a second embodiment of the invention;

FIG. 3 shows schematically a third embodiment of the invention;

FIG. 4 shows schematically a fourth embodiment of the invention;

FIG. 5 shows schematically a fifth embodiment of the invention;

FIG. 6 shows schematically a sixth embodiment of the invention; and

FIG. 7 shows schematically a seventh embodiment of the invention.

In the following description, a surface sizing process adapted to operate in different manners in conjunction with the press section of a papermaking machine is elaborated by way of example. Obviously, the same or essentially similar embodiments can be used in a boardmaking machine and others serving to apply a coating or other treatment substance on the surface of a web.

The embodiments shown in FIGS. 1 and 2 are particularly suited for being adapted into a part of the dryer section of a paper- or boardmaking machine when the machine is being rebuilt. In the illustrated embodiment, a coater or surface sizing station is located immediately prior to a dryer cylinder group 1, thus forming an integral part of the press section in the papermaking machine. As the described embodiments are primarily intended to be adapted into the press section during the rebuilding of a papermaking machine, the apparatus will form a part of the press section in the machine. In the embodiment shown in FIG. 1, the web being processed is passed on a felt or wire 2 to the surface sizing/press station. The support element, on which the web is transferred, may be the web-

forming wire of the machine or, if the web has already in the preceding steps been dewatered in a press nip, the press felt. The adherence of the web to the support element surface is assured by means of a suction roll 3.

5 From the suction roll, the web is passed to the next support element which is a felt 4. The web transfer from the delivering support element 2 onto the first felt 4 takes place with the help of a suction roll 5. The suction roll 5 presses the first felt 4 against the

10 support element 2, and the vacuum imposed by the roll 5 adheres the web to the felt. The first felt 4 transport the web to a first dewatering nip formed between the first felt 4, a second felt 6, a second suction roll 7 and a backing roll 8. The second suction roll 7 adheres

15 the web to the first felt 4 and, resultingly, the web passes over the suction roll 7 supported by the felt 4. Into this station is also adapted a spray applicator S1A suited for spraying the surface size on the outwardly oriented surface of the web. Next, the web is passed into

20 a nip formed between the transfer belt 9 and the first felt 4 at a point approximately coincident with the leaving point of the first felt from the perimeter of the second suction felt 7. The transfer belt 9 is a smooth-surface belt made from a metal, advantageously steel, or

25 from a reinforced/nonreinforced rubber or polymer material. A metal belt can be surfaced with a suitable material such as a ceramic coating, for instance. Also polymeric belts may be covered with a ceramic coating, and they may have a fabric-reinforced backing. The transfer

30 belt 9 moves supported by guide rolls and, in the travel direction of the belt, over a backing roll 10 that is mounted in front of the nip between the first felt 4 and the transfer belt 9. At the backing roll 10, there is adapted an applicator device S1B for spreading the

35 surface size on the belt 9. Advantageously, the applicator device is of the same type used as the applicator unit of film-transfer coaters, whereby the surface size

is metered and the size is smoothed on the belt surface by means of a rod or blade.

As is shown in FIG. 1, the applicator devices S1A and S1B
5 can be used alternatively or even simultaneously when a large amount of surface size has to be applied to the same surface of the web. Next, the transfer belt 9 with the web travelling thereon is passed into a nip between a deflecting backing roll 11 and a press roll 12, wherein
10 water is removed from the web toward the first felt 4. The transfer belt 9 with the web running thereon passes over the deflecting backing roll 11. In the illustrated embodiment, a shoe press 13 adapted to operate against the deflecting backing roll 11 over which a belt or the
15 felt 14 is adapted to pass. In order to apply surface size to the untreated side of the web, this embodiment has a spray applicator S2 adapted at a point along the web passage between the nip of the press roll 12 and its backing roll 11 and the nip between the shoe press 13 and
20 its backing roll. In this arrangement, the first coated side of the web will face the belt 14 that runs over the shoe press 13. If the nip of the shoe press is adapted to have a transfer belt on both sides thereof, no dewatering takes place in the nip, but rather, the press acts as a
25 calender that smooths the web surface. In some cases it is possible to use a felt in conjunction with surface sizing provided that the felt cleaning is properly arranged. The risk of felt plugging increases with the use of coating pigments.

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From the shoe press 13, the web travels on the transfer belt 9 out from the shoe press nip. The web is picked from the transfer belt 9 onto the dryer wire 15 of the dryer cylinder group by a third suction roll 16. Adher-
35 ence of the web to the felt is secured by means of a suction box 17, and the final drying of the web is carried out by means a dryer cylinder group 1, whereupon the web

is wound into machine rolls or, alternatively, is taken to further processing at finishing equipment connected to the paper- or boardmaking machine. After the web has left the transfer belt 9, the belt can be cleaned if necessary
5 with the help of water jets 18 and a scraper 19.

In the embodiment shown in the diagram, the press nip is adapted to operate in conjunction with the wire section, the felt 4 is replaced by a transfer belt, and the roll 5
10 has no suction facility but instead is advantageously adapted to operate with a backing roll. The coating is metered with the help of a spray applicator in front of the ingoing side of the nip formed between the roll 5 and its backing roll. In slow machines, the web can be passed
15 directly after the press nip between the rolls 7 and 8 to the cylinder dryer section. In this case, the roll 7 is advantageously a shoe roll, while the roll 8 can be a suction roll.

20 The embodiment shown in FIG. 2 is otherwise similar to that of FIG. 1 with the exception of having the first dewatering nip and felt removed, while a calibrating press is added. In this embodiment, the spray applicators S1A and S1B may be used alternatively or complementary to
25 each other, and the surface size is applied to the first side of the web by means of an applicator device adapted to operate in conjunction with the transfer belt 9. Resultingly, the shoe press 13 can be operated with a felt, thus permitting effective water removal toward the
30 uncoated side of the web, whereby the above-mentioned features of good dewatering from the web and size penetration therein are attained. The calibrating press SN is located downstream from the shoe press and comprises two rolls 20, 21 forming a nip therebetween through which the
35 web and its transfer belt 9 are adapted to pass. The first roll 20 is situated on the interior side of the endless loop of the transfer belt, while the second roll

21 is on its exterior side. An applicator device S2B is adapted to cooperate with the roll 21 located on the exterior side of the endless transfer belt, whereby the roll 21 performs as a film-transfer coater in cooperation with the applicator device S2B. In addition to carrying out the surface sizing, the calibrating press helps to improve the web smoothness in a conventional manner. The calibrating press used in this and other embodiments according to the invention described herein may be replaced by a calender proper, whereby generally two pairs of rolls are needed if the calender rolls comprise a heated hard roll and a soft-covered roll, for instance.

In FIG. 3 is shown an apparatus layout comprising two shoe presses. This embodiment may also be implemented using roll presses instead of shoe presses. As above, the web is again received from the preceding treatment section onto a wire 2 and then passed over a first suction roll 5 to a first felt 4. The first felt 4 travels via a first shoe press 22. The shoe press 22 is situated on the interior side of the endless loop of the first felt 4 and is pressed against a backing roll 26 about which another felt 27 passes. As this shoe press only serves to dewater the web, it is advantageous to have a felt adapted to both sides of the web. From the nip of the first shoe press 22, the web is transferred onto the second felt 27 and, in the downstream direction of the web travel after the shoe press 22, there is located a spray applicator unit S1 for applying surface size on the web side that is opposite to the web side facing the second felt 27. From the second felt 27, the web is transferred onto a third felt 31 by means of a suction roll 28 and next in the downstream direction of the web travel there is located a spray applicator unit S2A serving to apply coating to the web surface. In the downstream direction of the web travel is next located a second shoe press 29 having a third felt 31 and a transfer belt 32 adapted to pass

through its nip. The transfer belt passes over the backing roll 30 of the shoe press 29 and further over the applicator unit backing roll 33. At the applicator unit backing roll 33, to the exterior side of the endless transfer belt is adapted an applicator device S2B. Also herein, the applicator devices S2A and S2B may be operated in an alternative or complementary manner.

The embodiment shown in FIG. 4 is otherwise similar to that of FIG. 3 with the exception of a calibrating press SN which is added to the system for applying the surface size in lieu of the first press nip. Also the illustrated layout has an applicator device S2 adapted to cooperate with the roll 21 that is located on the exterior side of the calibrating press SN and, additionally, the diagram shows cleaning means 34 adapted about the exterior roll, that is, the applicator roll. Also the belt 32 may have cleaning means not shown herein. In FIG. 4 are also illustrated suction boxes 36 at the points where the web is transferred onto the next felt with the help of suction boxes. The suction boxes serve to assure the adherence of the web to the felt. In the downstream direction of the web travel, prior to the second shoe press, there is adapted a blow-down box, a dryer or a measurement device designated in the diagram as unit 37. The first applicator device is adapted to cooperate with the transfer belt 32, and the other side of the web is treated on the second roll 21 of the calibrating press SN and the applicator device S2 adapted to cooperate therewith.

In the embodiment shown in FIG. 5, the calibrating press SN is complemented with the application of a treatment substance with the help of a belt 36. The applicator belt 36 moves as an endless loop about the roll of the calibrating press SN and the applicator device S2 is arranged to apply surface size to the belt. The surface

size is transferred to the web surface in the calibrating press nip through which the applicator belt and the transfer belt 32 are adapted to pass. As the web passing through the nip has the applicator belt on its one side and the transfer belt on its other side, the function of the calibrating press may be controlled by a proper selection of the belt materials and, particularly, their hardness. In the embodiment shown in FIG. 6, the calendering effect has been augmented still further by using a shoe press as the calibrating press SN. The use of a shoe press also offers excellent facilities to the linear nip pressure profile control in the machine direction, thus allowing the thickness of a product being manufactured to be adjusted within a given smoothness of the web surface.

In FIG. 7 is shown an embodiment in which surface sizing is performed at the web-forming wire section, wherein the first dewatering step is performed. Herein, the solids content of the web is still very low. The web enters the treatment device transported by a dryer wire 2 of the paper- or boardmaking machine. On the dryer wire 2, the web is dewatered and its solids content increases. Still transported by the dryer wire, the web enters the shoe press formed by a shoe roll 40 and a backing roll 41. The dryer wire 2 passes over the backing roll 41 and the transfer belt 39 passes over the shoe roll 40. Thus, the web passes through the shoe press 40, 41 in the nip between the drying wire 2 and the transfer belt 39, whereby the water removal from the web takes place in the direction of the wire 2. In front of the nip formed between the drying wire 2 and the transfer belt 39, there is adapted a spray applicator device suitable for applying a web treatment substance to the web surface. As the web strength due to its high moisture content is low before it enters the shoe press, spray application is a particularly advantageous method of application in this

embodiment.

Next, the web is taken to a second press which advantageously is a shoe press as in the illustrated embodiment. The transfer belt 39 of the first shoe press 40, 41 travels over a shoe roll 42 of the second shoe press thus passing the web into the press nip. A backing roll 43 is adapted to press against the shoe roll 42 and a felt 44 passes over the backing roll 43. Also in this nip, water is removed from the web and the water removal takes place in the direction of the felt 44. Next, the web is passed supported by the transfer belt 39 onto a wire or felt 46. The web is adhered to the felt 46 with the help of a suction roll 45 mounted at the tangential meeting point of the transfer belt 39 with the felt 46. Depending on the paper or board grade to be produced, the web is next passed to a dryer cylinder group, an assembly of the kind described above for treating the other side of the web or to some other type of web treatment apparatus.

In addition to those described above, the invention may have alternative embodiments.

Obviously, the above-described embodiments may be modified in a plurality of ways. Particularly, the number and location of spray applicators may be varied as required from those illustrated herein. Instead of spray application, it is also possible to use so-called jet application, wherein a jet nozzle assembly as wide as the entire web width to be coated is used for ejecting a freely discharged jet of the treatment substance. As the jet applicator discharges the coating in a uniform jet free from droplet formation, the nuisance of coating mist formation is avoided. The jet can be directed to the surface of a belt, roll, web or directly into a nip. In the spirit of the invention, however, it is essential that a treatment substance is applied in at least one

transfer-belt-supported nip to that side of a web which faces the impervious belt. Preferred, the nip should have a impervious belt on the coated side of the web and a felt permeable to water on its other side. The pressing
5 force in the nip may be imposed either by means of rolls or, most advantageously, using a shoe press. This kind of nip achieves efficient water removal from the web and simultaneously subjects the web surface to application or calendering.

10

The web treatment substance such as a coating mix or surface size may also be applied to the surface of the transfer belt using, e.g., applicator devices similar to those employed in the film-transfer application technique. E.g., the assemblies elucidated in the exempli-
15 fying embodiments may also be modified by having a plurality of surface treatment and dewatering stations arranged to operate in-line so that the transfer belt is alternately facing the opposite sides of the web. The
20 invention is also adaptable to multilayer application, wherein at least one coating or web treatment layer is applied using the method according to the invention.

Although the technique according to the invention is most
25 advantageously implemented without having any unsupported passages in the machinery so that the web is at all times passed supported by at least one endless loop of a support element, a roll or a cylinder, it is possible in some special arrangements to transfer the web over an
30 unsupported passage or supporting the passage by air jets to the next support element. An air-impingement dryer, infrared dryer or the like may be used when so desired for drying the web after its treatment while the web is still travelling supported on a belt or felt, before the
35 web enters the next nip and before the treated side of the web becomes the supported side of the web or prior to the entry of the web into the dryer section. While the

- composition and state of the web treatment substance do not directly affect the function of the method according to the invention, they may require the use of certain types of applicator apparatuses or changes in the physical layout of the machinery. The web treatment substance may be in the form of a liquid, solution, dispersion, emulsion or foam, or any other kind of substance which is sufficiently easy to meter and apply.
- 10 The methods according to the invention may be complemented with coat weight measurement performed while the web is still supported on the belt or wire. Obviously, measurement equipment that operate from both sides of the web are unsuitable. One applicable technique for measuring the base sheet solids content and the coat weight, for instance, is the x-ray fluorescence method when CaCO_3 pigments are used. Any conventional technique of basis weight and moisture content measurement may then be combined with the x-ray fluorescence method, whereby a number of quality variables can be computed from the measurement data thus obtained.

What is claimed is:

1. Method for treating a moving web in a paper- or boardmaking machine, wherein

5

- forming a web on a moving wire,

- removing water from the web by pressing,

10

- drying the web by means of at least one dryer cylinder, and

15

- subjecting the web to surface treatment by means of at least one technique prior to the first dryer cylinder,

c h a r a c t e r i z e d in that

20

- arranging the web to travel supported by a transfer belt during at least one treatment step prior to said first dryer cylinder.

25

2. Method according to claim 1, c h a r a c t e r - i z e d in that a web treatment substance is applied to the web surface during at least one treatment step prior to the first dryer cylinder and the web is arranged to travel supported by a transfer belt (9) so that the side of the web to which the treatment substance is applied is facing the transfer belt (9), whereby the treatment substance is pressed by means of the transfer belt onto the web.

30

35

3. Method according to claim 1, c h a r a c t e r - i z e d in that at least one side of the web is calendered against a transfer belt.

4. Method according to claim 1, c h a r a c t e r -

i z e d in that the web is subjected to a surface treatment while its solids content is in the range of 10 - 60 %.

- 5 5. Method according to claim 1, 2 or 3, c h a r a c -
t e r i z e d in that the web is dewatered in at least
one step by pressing the web with the help of an endless
felt (14) against the transfer belt (9) by means of press
element (13).
- 10 6. Method according to claim 5, c h a r a c t e r -
i z e d in that the web is pressed by a felt (14)
against the transfer belt (9) in a shoe press (13).
- 15 7. Method according to claim 5, c h a r a c t e r -
i z e d in that the web is pressed by a felt (14) by
pressing it against a transfer belt (9) by a roll (12).
- 20 8. Method according to claim 1, c h a r a c t e r -
i z e d in that the web is dewatered by means of a
noncontacting dryer prior to the first dryer cylinder.
- 25 9. Method according to claim 1, c h a r a c t e r -
i z e d in that the web is being conveyed at least when
it is dewatered under pressing in a continuous contact
with at least one endless support element such as a wire,
felt or transfer belt
- 30 10. Method according to claim 1 or 2, c h a r a c -
t e r i z e d in that the web treatment substance is
applied to the surface of the transfer belt (9) by means
of a film-transfer applicator device, spray applicator,
jet applicator or short-dwell applicator, whereby the
treatment substance is applied to the web as a film which
35 travels on the surface of the transfer belt (9).
11. Method according to claim 1 or 9, c h a r a c -

t e r i z e d in that the web treatment substance is applied in at least one step directly to the web surface by means of a spray applicator (S1A, S2).

5 12. Method according to claim 1 or 9, c h a r a c -
t e r i z e d in that the web treatment substance is applied directly into the nip defined between the transfer belt and the web.

10 13. Method according to claim 1 or 12, c h a r a c -
t e r i z e d in that the web treatment substance is applied to the transfer belt and when necessary also directly to the web by an amount that forms a pond into the contact angle between the web and the transfer belt.

15 14. Method according to claim 1, c h a r a c t e r -
i z e d in that the web is treated in a calibrating press prior to passing the web to the first dryer cylinder.

20 15. Method according to claim 14, c h a r a c t e r -
i z e d in that the transfer belt (32) is adapted to pass through the nip of the calibrating press (SN).

25 16. Method according to claim 14 or 15, c h a r a c -
t e r i z e d in that the web is treated in a calibrating press having its nip defined between two rolls (20, 21), wherein the treatment substance is applied to one roll (21) of the calibrating press by
30 means of an applicator device (S2) and the treatment substance is subsequently transferred from the surface of the roll (21) to the web.

35 17. Method according to claim 15, c h a r a c t e r -
i z e d in that the web is treated in a calibrating press (SN) having a nip defined between two rolls (20, 21) and a belt (36) adapted to run about one roll (21),

wherein the treatment substance is applied to the surface of the belt of the calibrating press by means of an applicator device (S2) and the treatment substance is subsequently transferred from the surface of the belt (36) to the web.

18. Method according to claim 15, characterized in that the web is treated in a calibrating press (SN) having its nip defined between a roll (21) and a shoe roll (37) having a belt (36) adapted to run about the roll (21), wherein the treatment substance is applied to the surface of the belt (36) of the calibrating press by means of an applicator device (S2) and the treatment substance is subsequently transferred from the surface of the belt (36) to the web.

19. Method according to claim 2, characterized in that the web is adapted to pass through a nip defined between two transfer belts (32, 36) pressable against each other, wherein the treatment substance is applied to the surfaces of both belts (32, 36) and the treatment substance is subsequently transferred to both surfaces of the web.

20. Method according to claim 1, characterized in that the web during a dewatering step performed by pressing is supported at least partially by of a felt, belt, roll, cylinder or air blow/vacuum support means.

21. Method according to any one of claims 1, 8 - 20, characterized in that the web is dried after the application of a treatment substance during the first treatment step by means of a noncontacting dryer such as a radiant heat dryer or air-impingement dryer.

22. Method according to any one of claims 1, 10 - 21,

c h a r a c t e r i z e d in that at least two layers of treatment substance are applied at least to one side of the web during at least two separate web treatment steps.

5 23. Method according to any one of claims 1, 10, 22, c h a r a c t e r i z e d in that at least one layer of a web treatment substance is applied to the web by means of a film-transfer roll (21).

10 24. Method according to claim 1, c h a r a c t e r - i z e d by using a web treatment substance comprising surface size or coating mix in the form of a liquid, dispersion, emulsion or foam.

15 25. Method according to claim 1, c h a r a c t e r - i z e d in that the web is pressed against a roll by means of a transfer belt (9).

20 26. Assembly for a paper- or boardmaking machine, the assembly comprising

- a wire section (2, 3) for forming a moving web of paper or board,

25 - dryer means (4 - 14) for removing water from the web by pressing,

- at least one dryer cylinder (1) for drying the web, and

30

- at least one surface treatment device (S1A, S1B or SN) for treating the surface of the web prior to the first dryer cylinder (1),

35 c h a r a c t e r i z e d by

- at least one transfer belt (9) forming an endless

loop against which the web is arranged to travel during a surface treatment step.

27. Assembly according to claim 26, c h a r a c t e r -
5 i z e d by means (S1A, S1B) for applying a treatment substance to the web surface facing a transfer belt (9) in a manner that causes the applied substance to be pressed into the web by means of said belt (9).

10 28. Assembly according to claim 26 or 27, c h a r a c -
t e r i z e d in that at least one of a surface treatment devices is a calender.

29. Assembly according to claim 26, c h a r a c t e r -
15 i z e d by

- a felt (14) adapted to travel against said transfer belt (9) so that the web to be treated is passed between the felt (14) and the transfer belt
20 (9), and

- at least one pressing means (13) for pressing the felt (14) against the transfer belt (9) for removing water from the web by pressing.

25

30. Assembly according to claim 29, c h a r a c t e r -
i z e d in that said pressing means is a shoe press (13).

30 31. Assembly according to claim 29, c h a r a c t e r -
i z e d in that said pressing means is a roll (12).

32. Assembly according to claim 27, c h a r a c t e r -
i z e d by at least one noncontacting dryer means used
35 for drying the web prior to the first dryer cylinder.

33. Assembly according to claim 26, c h a r a c t e r -

i z e d by at least one felt (4), wire or belt (9) and means (5) for picking the web off from a web-forming wire (2) and passing the same supported by at least one felt (4), wire or belt to the next belt (9), felt or wire.

5

34. Assembly according to claim 33, c h a r a c t e r - i z e d by a wire (15) of a group (1) of dryer cylinders and means (16) for picking the web off from said transfer belt and passing the web at least partially supported by
10 said wire via said dryer cylinders (1).

15

35. Assembly according to claim 34, c h a r a c t e r - i z e d by at least one felt (4) and at least one transfer belt (9) for passing the web in a continuously supported manner and in continuous connection with said
endless loop support means through a pressing dewatering step.

20

36. Assembly according to claim 26, c h a r a c t e r - i z e d by means for applying a web treatment substance to the surface of the transfer belt, whereby said means may comprise a film-transfer applicator, spray applicator, jet applicator or short-dwell applicator device.

25

37. Assembly according to claim 26, c h a r a c t e r - i z e d by at least one spray applicator device (S1A) located within the area of the pressing dryer means for applying a web treatment substance directly to the web or into the nip defined between the web and the transfer
30 belt.

35

38. Assembly according to claim 26, c h a r a c t e r - i z e d by a calibrating press (SN) located in front of the dryer cylinders (1) or a calender through which the web is adapted to pass.

39. Assembly according to claim 38, c h a r a c t e r -

i z e d in that the transfer belt (9) is adapted to pass through the calibrating press.

40. Assembly according to claim 39, c h a r a c t e r -
5 i z e d by means (S2B) for applying a web treatment substance on a roll (21) located on the exterior side of the endless-loop transfer belt (9) of the calibrating press (SN).

10 41. Assembly according to claim 38 or 39, c h a r a c -
t e r i z e d by a belt (36) adapted to pass as an endless loop over said roll (21) located on the exterior side of the endless-loop transfer belt (9) and by means (S2) for applying a web treatment substance on the
15 surface of said belt (36).

42. Assembly according to claim 41, c h a r a c t e r -
i z e d in that said calibrating press (SN) comprises a shoe press (37).
20

43. Assembly according to claim 26, c h a r a c t e r -
i z e d by

- at least two transfer belts (32, 36) adapted to
25 move at least a portion of their travel opposed to each other so that the web is passed therebetween,

- means (S1, S2) for applying a web treatment substance to the surfaces of the belts (32, 36), and
30

- means (20, 21) for pressing said belts (32, 36) against each other for setting up an application pressure.

35 44. Assembly according to any one of claims 26, 36, 37, 40, 43, c h a r a c t e r i z e d by at least one noncontacting dryer such as a radiant heat dryer or air-

impingement dryer serving to dry the web after the application of a web treatment substance.

45. Assembly according to claim 26, c h a r a c t e r -
5 i z e d by at least one film-transfer roll (21) for
applying a web treatment substance to the web surface.

46. Assembly according to claim 26, c h a r a c t e r -
i z e d in that at least one transfer belt is adapted to
10 pass over the roll in a manner permitting the web to be
pressed by means of the transfer belt against the roll.

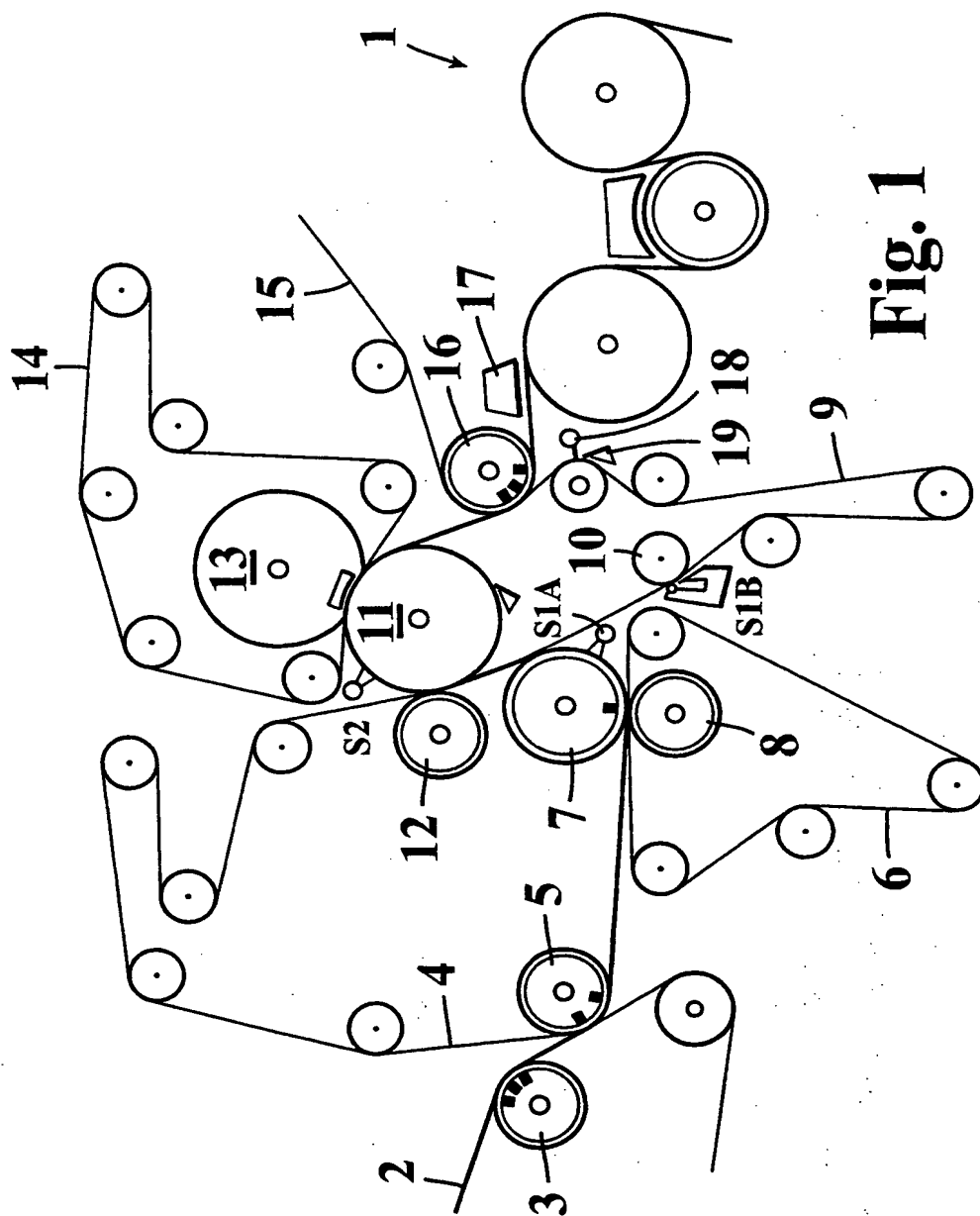


Fig. 1

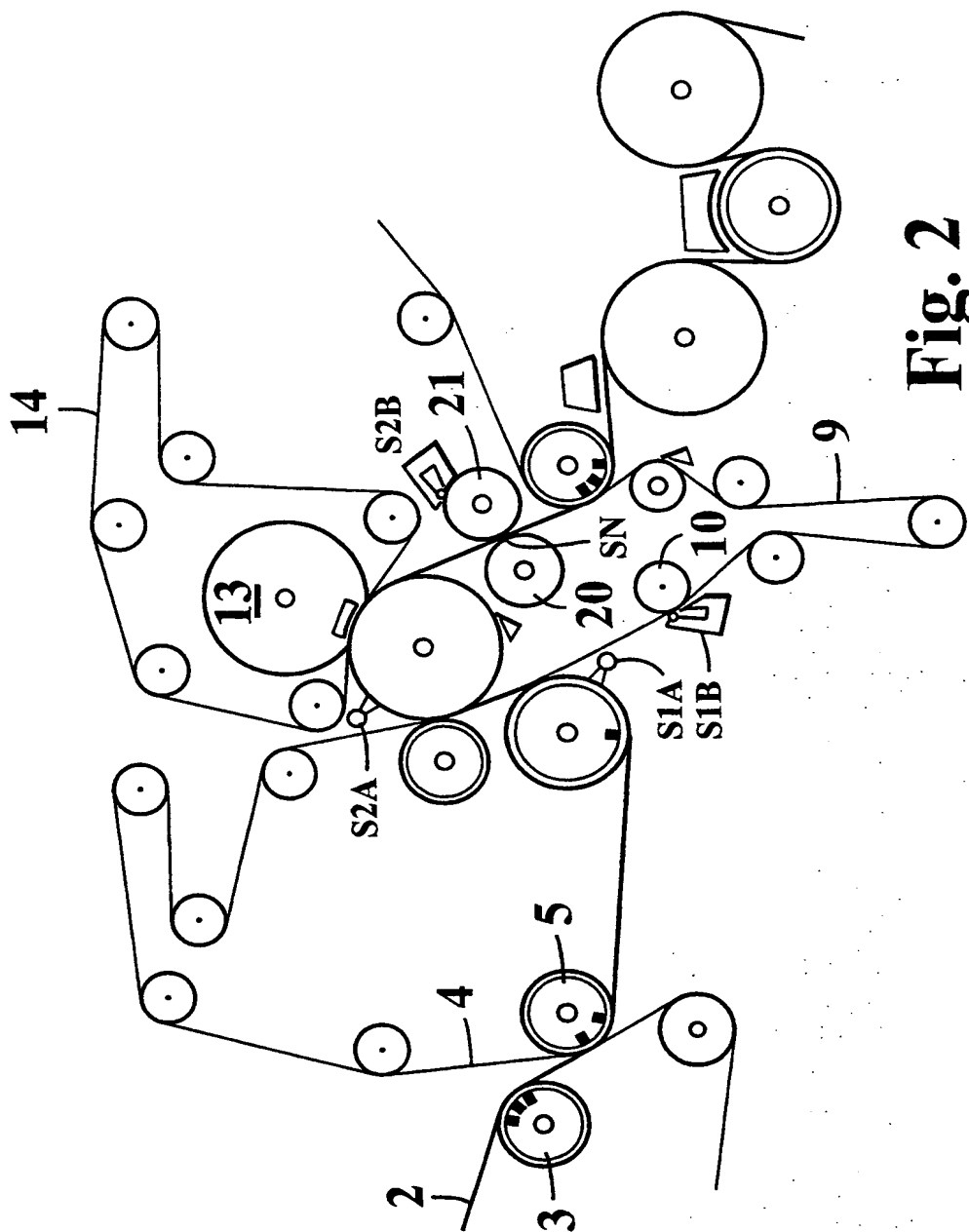


Fig. 2

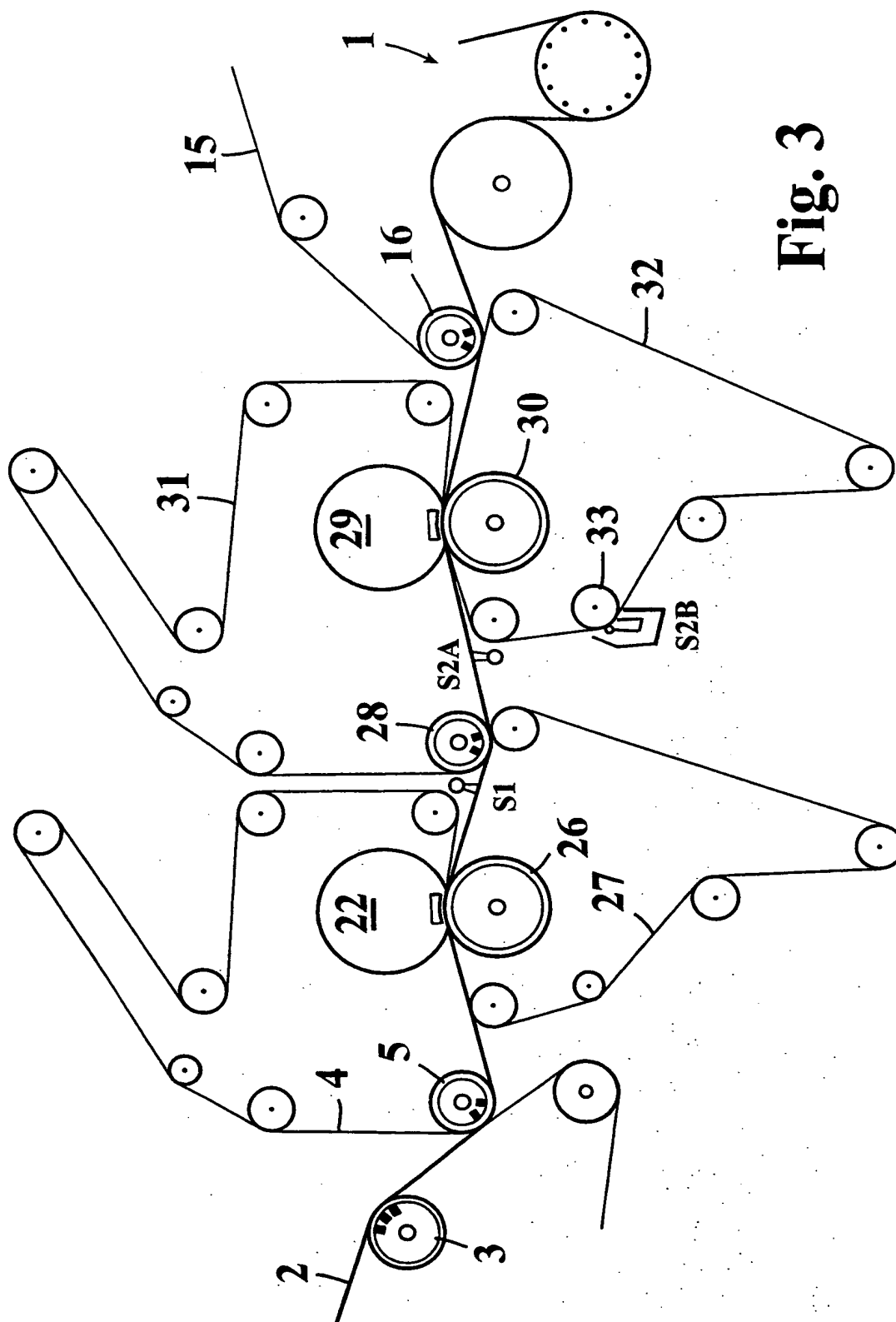


Fig. 3

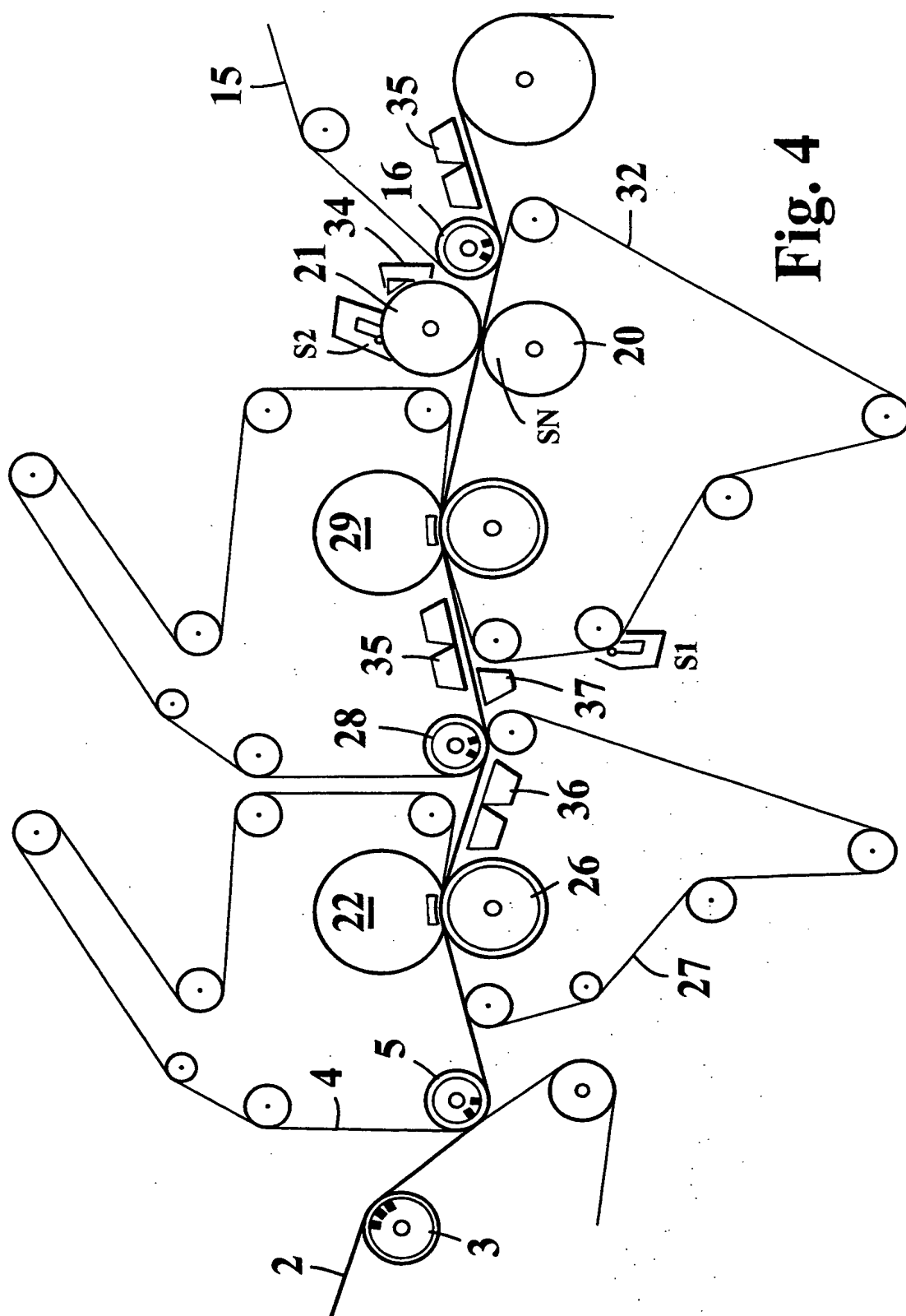
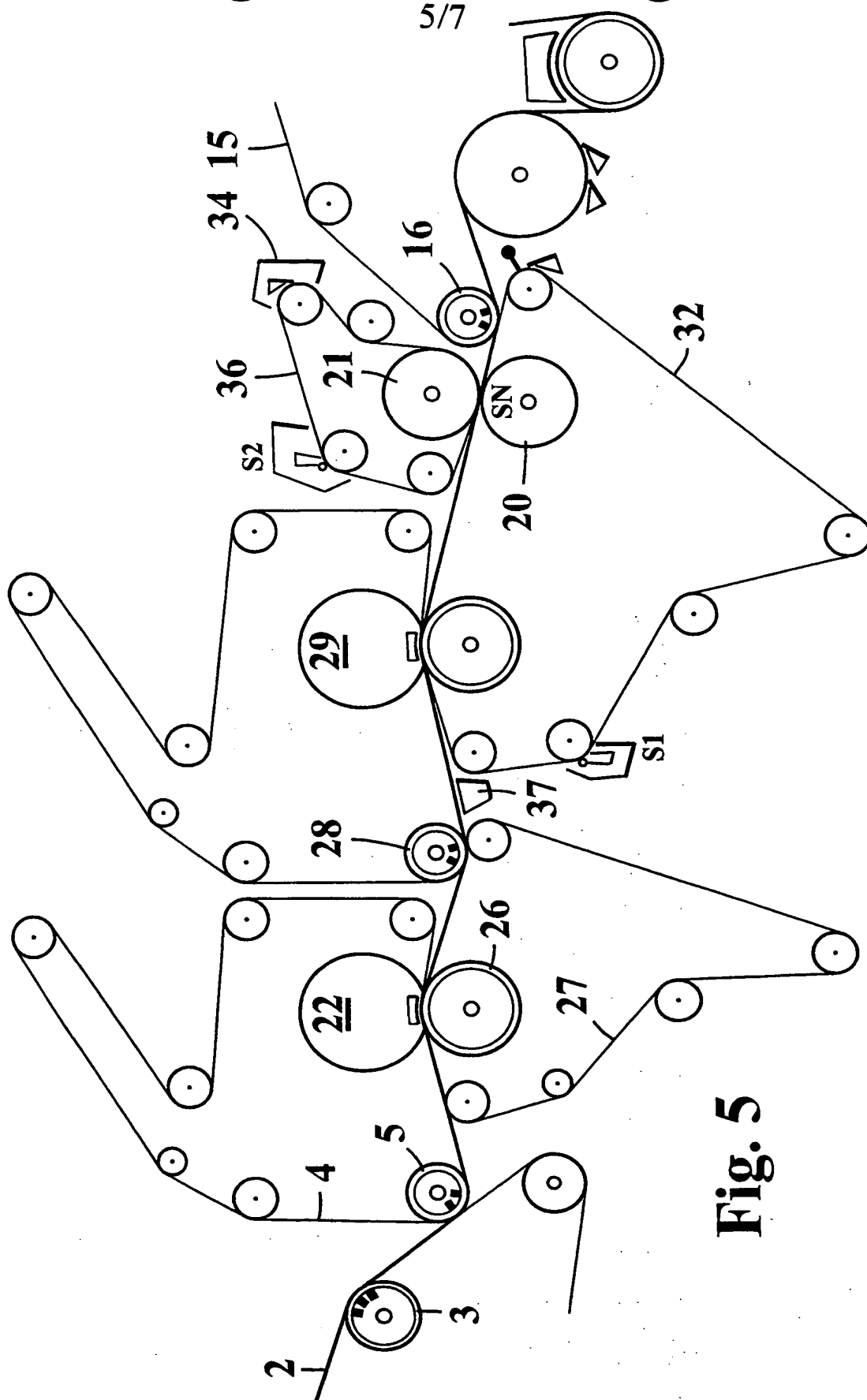


Fig. 4



Fi.5

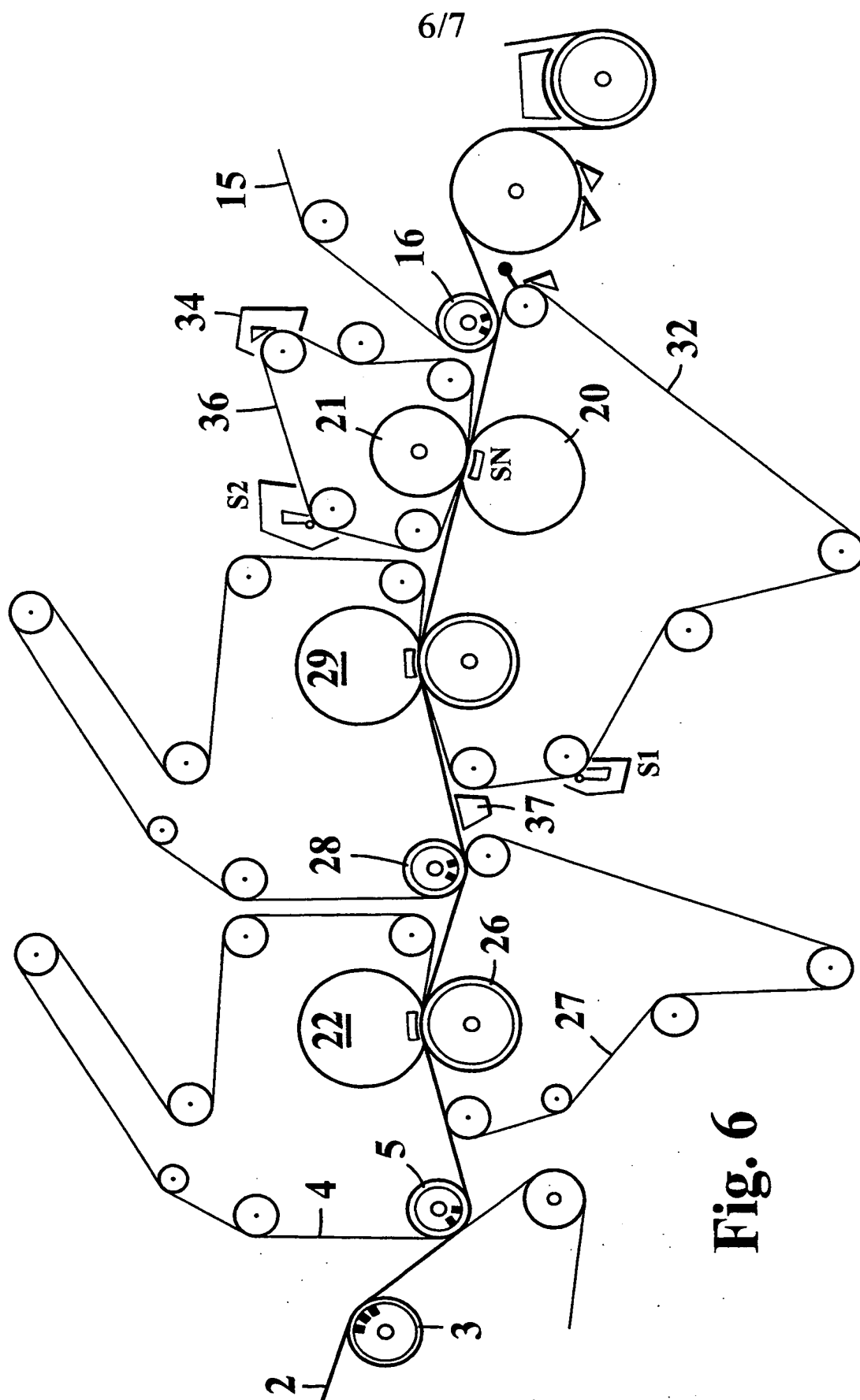


Fig. 6

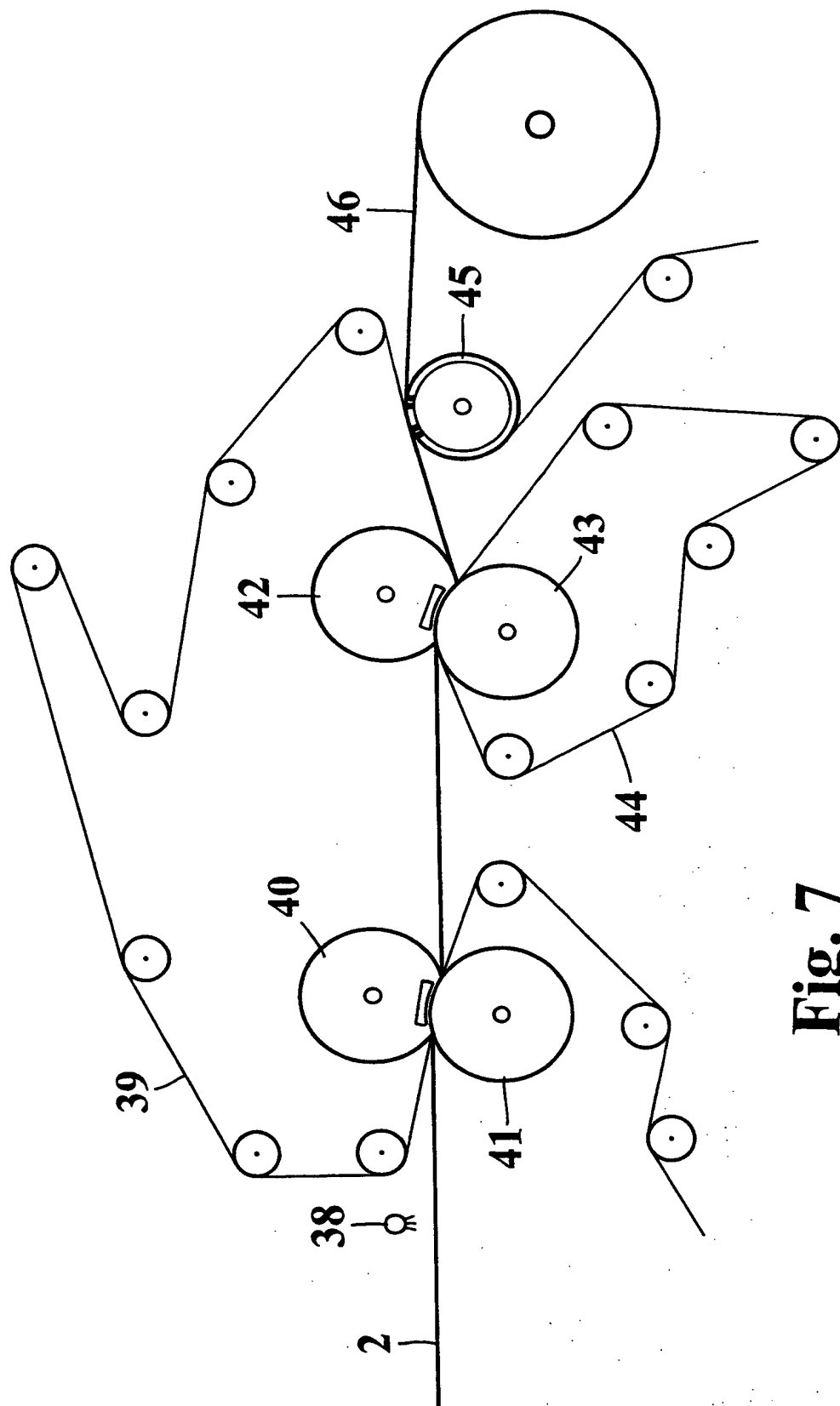


Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00190

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21H 23/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	DE 19823739 A1 (VOITH SULZER PAPIERTECHNIK PATENT GMBH), 11 November 1999 (11.11.99), column 3, line 28 - line 56, abstract --	1-46
X	EP 0881329 A2 (MITSUBISHI HEAVY INDUSTRIES, LTD.), 2 December 1998 (02.12.98), column 8, line 22 - line 31, figure 8, claims 1-2 --	1,3-9,11, 14-17,20-26, 28-35,37-42, 44-46
X	US 5575891 A (PAUL D. TROKHAN ET AL), 19 November 1996 (19.11.96), column 9, line 57 - column 10, line 34, figure 1 --	1-46

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

14 June 2000

Date of mailing of the international search report

19-06-2000

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 00/00190

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	GB 459125 A (THE MEAD CORPORATION), 29 December 1936 (29.12.36), page 2, figure 1	1-46
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INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.

PCT/FI 00/00190

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GB 459125 A	29/12/36	NONE	